ENGAGING SPECIAL EDUCATION TEACHERS IN DATA-DRIVEN DECISION-MAKING THROUGH THE USE OF THE KIHD SYSTEM EFFECTS ON TEACHERS' USE OF EVIDENCE-BASED STRATEGIES

by

Dorothy X. Zhang

A Dissertation
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of
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DEDICATION

This work is dedicated to my family and friends who understood and supported me all these years and to all the special people whom I encountered along the way who helped me to keep pursuing my interests in this field.

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LIST OF ABBREVIATIONS

Applied Behavior Analysis ..... ABA
Attention Deficit Hyperactivity Disorder ..... ADHD
Contingent Behavior Specific Praise ..... CBSP
Group Opportunities to Respond ..... GOTR
Individualized Education Plan ..... IEP
Individuals with Disabilities Education Act ..... IDEA
Interobserver Agreement ..... IOA
Kellar Instructional Handheld Data System ..... KIHd
No Child Left Behind ..... NCLB
Opportunities to Respond ..... OTR
Percentage of Nonoverlapping Data ..... PND
Positive Behavior Support ..... PBS

ABSTRACT

ENGAGING SPECIAL EDUCATION TEACHERS IN DATA-DRIVEN DECISION-MAKING THROUGH THE USE OF THE KIHD SYSTEM EFFECTS ON TEACHERS' USE OF EVIDENCE-BASED STRATEGIES

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Collecting data, making instructional decisions based on data, and implementing evidence-based classroom management and instructional strategies are all important skills for teachers to exercise. However, due to a multitude of barriers and a disconnect between research and practice, these skills may be applied inconsistently across educational settings. This study examined the effect of an intervention involving the self-monitoring and visual performance feedback embedded in a data-collection application (the KIHd system) and self-evaluation of teachers' data-driven decision-making to apply contingent behavior specific praise and group opportunities to respond to academic instructions. Three teachers in a writing class within a postsecondary program for young adults with intellectual or developmental disabilities participated in this study. A single-subject, multiple-probed across participants research design was used to examine the research questions. The results of the study suggested that there was a functional

relationship between self-monitoring and visual performance feedback and the use of contingent behavior specific praise and group opportunities to respond to academic instructions. The addition of self-evaluation led to an increase in both target behaviors for one participant, suggesting a possible effect of this intervention component. The social validity interviews supported the practicality and effectiveness of this intervention through the lens of the participants. These study findings suggest that using an electronic data-collection tool for self-monitoring may be an effective and cost efficient way to promote the use of evidence-based classroom management strategies among special education teachers.

CHAPTER ONE

According to the No Child Left Behind Act (NCLB, 2001) and the Individuals with Disabilities Education Act (IDEA, 2004), collecting data, using data to make instructional decisions (also known as data-based decision-making, or DDDM), and incorporating evidence-based classroom management strategies in the classroom are important skills for all teachers to regularly exercise (Simonsen, Fairbanks, Briesch, Myers, & Sugai, 2008). During the past decade, wireless technology such as the handheld computer (PDA) has been introduced and used for data collection and data-based decision-making processes in medical education (Koeniger-Donohue, 2008) and other educational areas (Ferguson, Myles, & Hagiwara, 2005; Gregg, 2009). The PDA is a palm-size computer that can be used for data collection. During recent years, with the tremendous growth of the smartphone, smartphone compatible applications have become another means to facilitate the data-collection process and the subsequent decision-making process in areas such as health (Handler et al., 2013) and education (Wayman, 2005). One such app that exists in the field of special education is the Kellar Instructional Handheld data (KIHd) system.

The present study explored the observed effects on behavior of using features from the KIHd system as a facilitator for data-driven decision-making to inform the teaching practices of special education teachers who work with young adolescents with

intellectual and developmental disabilities in a postsecondary program. This intervention study incorporated self-management, including self-monitoring and self-evaluation, to increase the teachers' use of evidence-based classroom management strategies. Other components embedded in the study were visual performance feedback and data-driven decision-making regarding instructions. In this report data-based decision-making, and data-driven decision-making are used interchangeably to describe the same concept.

Background of Problem

NCLB (2001) and IDEA (2004) both mandate accountability in teaching as well as maximized access to the general education curriculum for students with special needs. Furthermore, both acts require evidence-based strategies for teaching as well as data-driven decision-making to promote student progress and to examine whether students are advancing toward their goals and benchmarks. Decisions that are based upon data can produce responsive modifications to instructional strategies and programs (Kabot, Masi, & Segal, 2003). For data such as standardized test scores and other performance data to be useful, they should be current and accurate; in addition, decision-makers who know how to use these data must have access to them (Mandinach, Honey, & Light, 2006).

In the field of special education, teachers are faced with the necessity of collecting and using data to support their decision-making. The number of students who receive special education services has increased, and the mandated expectation is for teachers to provide evidence for students' learning progress on an individual basis. The evidence is often presented and supported by data on students' performances toward learning objectives (Yell, Drasgow, & Lowrey, 2005). Decisions that are made based on data tie

in closely with each student's Individualized Educational Plan (IEP). The use of assessment data can promote objective decision-making, reveal incremental improvement or stagnated progress (Janney & Snell, 2003), and predict future progress (McLean, Wolery, & Bailey, 2004). Effective use of assessment data includes summaries of the results, graphs, and rule-based decisions (McLean et al., 2004). Ongoing tracking of student progress and behavior change may help teachers make more appropriate instructional decisions (Deno, 2003), which then lead to better student outcomes (Todman & Dugard, 2001).

While collecting data, making decisions based on data, and using evidence-based strategies are important skills for special educators to have and exercise, these skills can be difficult to acquire or challenging to execute (Graff, 2007). Traditional data collection is done with paper and pencil, a task that can be cumbersome and time consuming. Some schools may require teachers to collect data, but the data are often not transformed into a format that enables visual analysis; as a result, effective decision-making becomes difficult. When data must be graphed, this work is sometimes not completed until the end of the week or the month, given teachers' heavy teaching loads and other daily obligations. This delay in graphing precludes timely decision-making and may result in the perpetuation of ineffective instruction, whereas timely examination of the graphed data might have resulted in a change in instructional methods (Graff, 2007).

Collecting data and making decisions based on data may not be an easy task for special education teachers. According to Grigg, Snell, and Loyd (1989), when making decisions, special education teachers relied less on the graphs they produced and more on

their experience and intuition. Furthermore, managing data collection is difficult (Farlow & Snell, 1989) especially with an increase in student caseloads (Deno, 2003). Balancing teaching and data collection can also be a challenge for teachers given their numerous duties (McLean et al., 2004). Another challenging situation is the variability in teachers' competency in collecting data, which becomes another barrier for making effective instructional decisions (Katsiyannis, Zhang, & Conroy, 2003). Sandall, Schwartz, and Lacroix (2004) concluded that barriers to data collection and analysis are in four areas: nature of setting, data management, time, and nature of the IEPs. The authors also expressed the need for incorporating technological support to integrate data collection into daily activities for students with special needs.

There have been attempts to understand different aspects of data collection and making data-driven decisions, including how to promote teachers' acquiring such skills and efforts to understand teachers' beliefs about data collection and DDDM. For example, in a study conducted by Cooke, Heward, Test, Spooner, and Courson (1991), after surveying 510 special education teachers, the researchers discovered that most teachers collect, record, and use data to determine the effectiveness of their instruction. This approach allowed teachers to make further decisions about instruction such as when to move students forward to the next learning objectives and whether the learning objectives had been met.

Other studies have examined the effect of training on data collection and making data-based decisions (Jimenez, Mims, & Browder, 2012; Utley, Zigmond, & Strain, 1987). For instance, a study conducted by Utley and colleagues (1987) examined the

ability of undergraduate and graduate students in special education or related fields to make appropriate interpretations based on data. The authors found that teachers who received the training were able to identify more data patterns and make more appropriate data-based decisions than those who did not receive the training.

In the special education setting, another study conducted by Jimenez et al. (2012) demonstrated that special education teachers who work with students with severe developmental and intellectual disabilities can obtain skills to make data-driven decisions by following specific guidelines using an online professional development model. All of the studies discussed above support the contention that teachers can acquire data collection and decision-making skills through training. Further studies are needed to examine the actual use of data-based decision-making during instruction and ways to minimize the barriers for data collection and data-based decision-making.

Researchers have examined the use of data in the special education setting using a qualitative research design. In a study conducted by Grigg et al. (1989), 11 teachers of students with severe disabilities were interviewed about how they used data to support decision-making regarding instructional strategies. Researchers discovered that teachers relied more on "intuition" than on data when making decisions about instructional strategies. Furthermore, teachers with more experience relied more on intuition. Teachers also did not interpret student data consistently, believing that data and graphs might not present an accurate image of the students' performance. Results of this study contradicted findings reported by Cooke and colleagues (1991) that pointed to inconsistencies in data collection and data use among special education teachers in the

field. Cooke and colleagues suggested that a support system, which includes training and a tool for data collection, might help encourage teachers to buy into collecting data and therefore increase the probability of data-based instructional decision-making.

Although some teachers do gather data to help them in making decisions, some teachers either may not use the data they collect or find collecting data a daunting task given their level of experience with data collection and their workload. Therefore, electronic means could automate data collection and facilitate the data-based decision-making process (Shi, Graff, & Wang, 2006; Sulser, 2006; Wayman, 2005). Wayman (2005) suggested that computer technologies and information management software applications could help with the decision-making process. Shi and colleagues (2006) also suggested that handheld data-collection systems such as smartphones and computer tablets could support documenting progress and making data-driven instructional decisions. Using such tools might also reduce the time needed for data collection, thus providing teachers with extra time to complete other tasks. Computer or other electronic technologies might help in the collection and sorting of large amounts of data. Some technology could also provide user-friendly interfaces, which would allow for easier data analysis. Through data analysis, teachers can make relevant decisions about instruction. Despite these suggestions, there is limited research to date that has focused on the impact of using technology for this purpose, particularly in understanding how using technology in data collection might change teachers' instructional behaviors. This lack of understanding led to the development of this study.

The current study incorporated the KIHd system. This system is an electronic data-collection application tool created to help teachers and parents collect behavioral data more effectively than with the traditional paper-and-pencil method. The KIHd system was created based on the principles of applied behavior analysis (ABA) and is used to collect real-time data on student behavior at an individual level; it includes a self-generated graphing feature, which can provide immediate visual feedback for users such as teachers, parents, or other educators to use in making decisions about instruction. This tool saves time, which allows educators to engage in other work-related tasks. Users can collect data on a single student or on multiple students. Data then can be analyzed at an individual level or in an aggregated format by exporting data into a statistical analysis tool such as Microsoft Excel or the Statistical Package for the Social Sciences. This system contains elements including accessibility, length of the feedback loop, comprehensibility, flexibility, alignment, and links to instructions, which are essential for electronic tools to work effectively (Mandinach et al., 2006). More information about the development and functioning of the system is provided in the next chapter.

The use of evidence-based practices, which also rely on data-driven decision-making, is another concept emphasized by both NCLB and IDEA. Evidence-based practice is defined as an instructional strategy, intervention, or teaching program that has resulted in consistent positive outcomes when tested experimentally (Mesibov & Shea, 2011). As recognized by most organizations, an evidence-based practice is validated in several ways: first, by the use of a sound experimental or evaluation design and appropriate analytical procedure; second, through empirical validation of effects; third,

with clear implementation procedures; fourth, with replication of outcomes across implementation sites, and fifth, through providing evidence of sustainability (Kerr & Nelson, 2006).

Evidence-based practices also play an important role in creating an optimal learning environment for students in terms of classroom management (Simonsen et al., 2008). According to Walker, Shea, and Bauer (2004), classroom management can be defined as "actions that teachers engage in to enhance the probability that children will develop effective behaviors that are personally fulfilling, productive, and socially acceptable" (p. 7). The American Psychological Association conducted a Teacher Needs Survey from 2005 through 2006. Participants in this online survey included 2, 334 teachers from 49 states and the District of Columbia participated in this online survey. Results showed that 52% of the first year teachers, 28% of teachers with two to five years of teaching experience, and 26% of teachers with six to 10 years of teaching experience reported classroom management as the most needed area for support (Coalition for Psychology in School and Education, 2006). Teachers capable of exercising adequate classroom management are crucial for general classrooms as well as for special education classrooms.

To address the importance of classroom management, Sugai and Horner (2006) proposed the use of a positive behavior support (PBS) approach for building an effective educational environment. Four elements were included in this model: (a) social competence and academic achievement, (b) supporting staff behavior, (c) supporting student behavior, and (d) supporting decision-making. That is, first PBS emphasizes

measurable student and teacher outcomes that are valued by people of interest. Second, the practices and curricula chosen for the students have been validated through research. Third, decisions that are made in a PBS environment must be driven by data, which are applied at the individual, classroom, and school levels. Finally, PBS is focused on creating a system that supports student behaviors and that is effective, efficient, and relevant. This system includes analysis and intervention at several levels: schoolwide, classroom, nonclassroom, and individual. The current study focused on the classroom level, specifically, teachers' use of effective instructional classroom management strategies.

According to Sugai and Horner (2006), classroom management should include the following three components: (a) teachers should directly teach students about the expectations and rules in the classroom, (b) teachers should maximize the use of behavior management practices, and (c) teachers should structure the learning environment not only to maximize the delivery of instruction, but also to focus on promoting socially desirable behaviors. Sugai and Horner explained that PBS and the elements included in this system are examples of applications of ABA, complying with its dimensions, which are the conceptual framework of this study.

The discussion provided by Sugai and Horner (2006) has been extended and supported by several studies that have examined classroom management and its impact on students. For example, research shows that teachers' classroom management skills positively correlate with student achievement (Wang, Haertel, & Walberg, 1997) and allow for learning to occur (Oliver & Reschly, 2007). A lack of classroom management

skills may lead to a decrease in learning opportunities and an increase in problematic behavior (Wagner, Kutash, Duchnowski, Epstein, & Sumi, 2005). When managing a classroom it is important for teachers to use evidence-based practices to ensure that time for instruction and academic engagement and achievement are maximized and problematic behavior is under control.

Despite the importance of incorporating evidence-based strategies into classroom management and into teaching, it is often difficult for teachers to implement these strategies in their classrooms. Gaughan (2008) conducted a descriptive, two-phase, sequential mixed methods case study, which explored implementation of evidence-based practices in a rural school district. Online surveys distributed to special education teachers and administrators and interviews of special education teachers in that district revealed that these teachers did have training and skills in and knowledge about evidence-based practices, and they were in favor of using such practices. However, there were barriers to teachers' exercising evidence-based practices, including limited resources, lack of membership in professional organizations, and a lack of time, outside of the teachers' work time, to acquire information about evidence-based strategies.

Researchers have investigated different models to promote implementation of evidence-based strategies such as providing group training, performance feedback, and self-management strategies. *Self-management* is the process of managing one's own behavior (Simonsen, MacSuga, Fallon, & Sugai, 2013). B. F. Skinner was the first to discuss the concept of self-management, using the term "self-control"; he stated that

people manage their own behaviors similarly to how they manage the behaviors of others (Skinner, 1953).

Self-management has been defined as "the personal application of behavior change tactics that produces a desired change in behavior" (Cooper, Heron, & Heward, 2007, p 704). Through self-management the desirable behavior of an individual will occur more frequently, while undesirable behavior will occur less frequently. Self-management is a process that is composed of self-monitoring, self-evaluation, and self-reinforcement of one's own behavior, and involves a person recognizing and recording the occurrence or nonoccurrence of a target behavior using a recording method (King-Sears & Carpenter, 1997).

Self-monitoring has been proven either to increase or decrease certain behaviors of children with disabilities. Research studies showed that self-monitoring increased students' preparedness for class (Creel, Fore, Boon, & Bender, 2006), decreased the occurrence of inappropriate behavior in the classroom (Webber, Scheuermann, McCall, & Coleman, 1993), and increased attending to tasks and academic accuracy (Holifield, Goodman, Hazelkorn, & Heflin, 2010) and on-task behavior (Gulchak, 2008).

Although more and more is understood about student behavior, due to a paucity of research little is known about the effects of using electronic devices as self-monitoring tools to change teachers' behavior. To address this gap in current research, the current study investigated the use of an electronic data-collection app (the KIHd system) as a tool to facilitate self-monitoring and provide visual performance feedback on teachers' decision-making regarding the use of evidence-based classroom management strategies.

The behaviors selected for this intervention study were contingent behavior specific praise (CBSP) and group opportunities to respond (GOTR) to academic instruction, which will be explained further in the literature review section. This intervention was built upon characteristics and principles of ABA, which emphasizes the use of data to make instructional or treatment decisions for individuals with or without a disability.

Performance Feedback

Performance feedback is defined as "information about performance that allows an individual to adjust his or her performance" (Daniels, 1999, p. 101). In the field of education, performance feedback has been used to support teacher behaviors and practices (L'Allier, Elish-Piper, & Bean, 2010). The objective of performance feedback is to improve the target behavior(s) measured by the observer or performance analyst. It is believed that when results from use of this method are compared with results from providing training or providing incentives alone, providing performance feedback produces greater changes in behavior (Fixsen, Naoom, Blasé, Friedman, & Wallace, 2005).

Performance feedback has been used to address teachers' use of CBSP and opportunity to respond (OTR) in the classroom. To summarize current knowledge in this area, Cavanaugh (2013) conducted a literature review on performance feedback and teachers' use of praise and OTR. Findings from this literature review suggested that providing performance feedback might be an effective approach for improving teachers' use of praise with or without a separate training component focusing on the target behaviors. In terms of OTR the effect of using performance feedback is less clear. Based

on this review of 33 articles, performance feedback was delivered using a variety of methods, such as graphs (Colvin, Flannery, Sugai, & Monegan, 2009; Rathel, Drasgow, & Christle, 2008), written feedback (Hemmeter, Snyder, Kinder, & Artman, 2011), performance feedback in conjunction with goal setting (Kalis, Vannest, & Parker, 2007), and other methods.

Research shows that performance feedback can improve an individual's task performance. Performance feedback in schools is often provided by outside consultants, thus increasing the cost for this service. For some schools, performance feedback is not a feasible option to support teachers in their work environment (Simonsen et al., 2013). Therefore, other modified or alternative methods should be explored that serve the same purpose as providing performance feedback. The purpose of this study was to examine a modified way to provide performance feedback, which is the use of visual performance feedback generated by the KIHd system. Another component of this study was self-monitoring, which occurs before visual performance feedback is received.

Conceptual Framework

Data-based decision-making is one of the defining characteristics in ABA, which is a science that investigates the relationship between behaviors and their environment (Cooper et al., 2007). The defining characteristics of ABA include that it is applied, behavioral, analytical, effective, generality, technological, and conceptually systematic for behavioral changes (Baer, Wolf, & Risley, 1968). It is important to note that in ABA, *technological* refers to the identification and description of the operative procedures in a study, characteristics which enable replication (Cooper et al., 2007). This description is

different from the more common definition of technology, which refers to technology as using machinery and equipment that have been developed with scientific knowledge.

With decades of empirical support, the incorporation of principles and procedures of ABA can produce socially significant behavior changes for individuals in a variety of settings, including educational settings. Behavior analysts make decisions based on a visual inspection of data to ensure that the instructions are effective for learners. The present study was built upon the principles and procedures of ABA in several ways. First, this intervention was designed to promote several operationally defined teacher behaviors that are socially significant. Second, the intervention (using the KIHd system as a tool for self-monitoring and visual performance feedback) is grounded in ABA and the operant nature of the target behaviors particularly in discrete trial training and precision teaching. Third, the intervention procedures are described with sufficient detail to enable others to replicate the results. Fourth, a single-subject research design was used, and subsequent data analysis was conducted to monitor, evaluate, and make decisions regarding the effectiveness of this intervention. Finally, the aim for this intervention was to create long-lasting behavior change with a well-established single-subject research design. Given the behavioral analytic nature of this intervention, the following chapters were written through the lens of ABA.

Purpose of the Study

The present study was built upon a study conducted by Simonsen and colleagues (2013) that examined the impact of using self-monitoring in the implementation of evidence-based classroom management strategies. The purpose of the current study was

to examine the use of the KIHd system as: 1) a self-monitoring tool for teachers, 2) a device to provide visual performance feedback (examining the graphs that KIHd generates), and 3) a self-evaluation tool for teachers to assess their data-driven decision-making to use CBSP and GOTR during academic instruction in a postsecondary program for adolescent students with intellectual or developmental disabilities.

As described earlier, the KIHd system was developed for educators and parents to collect behavioral and instructional data on students. It can collect data and generate graphs based on the data. Exporting the data into computer software such as Microsoft Excel or Statistical Package for the Social Sciences enables further analysis. The KIHd system was not developed as a self-monitoring tool for teachers. However, the current study examined the possibility and effectiveness of using the KIHd system as a self-monitoring and visual performance feedback device to create change in teachers' instructional behavior including CBSP and providing GORT to academic instruction for students.

Research Questions

The first research question for this study is, "Is there a functional relationship between the use of the KIHd system (as a self-monitoring device and a means to provide visual performance feedback) and the use of contingent behavior specific praise (BCSP) and group opportunities to respond (GOTR) to academic instructions for special education teachers who work with postsecondary students with intellectual or developmental disabilities?" There are two related subquestions: (a) Does the use of the

KIHd system affect the rate of CBSP during academic instruction? (2) Does the use of the KIHd system affect the rate of GOTR to academic instructions?

The second research question is, “During the intervention in which the KIHd system is used for self-monitoring and visual feedback, if participants' behaviors are not observed to change, will the addition of self-evaluation create an increase in contingent behavior specific praise (CBSP) and group opportunities to respond (GOTR) to academic instructions among special education teachers who work with postsecondary students with intellectual or developmental disabilities?” There are two related subquestions: (a) Does the use of self-evaluation affect the rate of CBSP during academic instructions? (b) Does the use of self-evaluation affect the rate of GOTR to academic instructions?

Significance of Study

As stated earlier, data collection, data-driven instructional decision-making, and the use of evidence-based classroom management strategies are all important skills for teachers to exercise. However, teachers continue to struggle with acquiring and applying these skills in their work environment. Two teacher-centered behaviors that were selected for this study were CBSP and GOTR to academic instructions. Previous research has found that these two behaviors could lead to better classroom management and improvement in student behaviors (Sutherland & Wehby, 2001; Sutherland, Wehby, & Copeland, 2000).

One way to increase a teacher’s use of evidence-based practices in the classroom is through self-monitoring. However, more research is needed to broaden our understanding about this topic such as examining its effectiveness in a postsecondary

special education environment. Another way to improve performance is by having a consultant provide performance feedback to the teacher. However, this level of support can be time consuming and expensive and relies on the consultant instead of on teachers themselves. The current study examined the effects of using an electronic data-collection app and its embedded components as a means to reduce the need for outside support by increasing the teachers' own decision-making.

To promote data collection, data-based decision-making, and the use of evidence-based classroom management skills this study used an intervention package that included training, self-monitoring, visual performance feedback, and self-evaluation to promote data-based decision-making to implement CBSP and GOTR to academic instructions. Self-monitoring and performance feedback were embedded in a mobile device data-collection system app, the KIHd system, which served as a tool for this study. Another component of the intervention package was self-evaluation, which involved following a guided script to reflect and to make decisions about future teaching.

In comparison with the studies in the existing literature, this study was one of the few attempts to examine the impact of the use of features embedded in data-collection apps as a way of promoting the teacher's use of evidence-based classroom management strategies through data-based decision-making. This study was conducted in a postsecondary educational program for students with developmental or intellectual disabilities, which was a new context in which to explore this research topic.

The role of handheld devices (such as PDAs, palmtops, and mobile phones) in K–12 settings was assessed by Cheung and Hew (2009) in a review article involving 44

peer-reviewed articles. One of their research questions focused on the research topics that investigated use of handheld devices. The researchers found four areas of research including usage profile, viability as an assessment tool, student learning outcomes, and student attitudes toward the use of handheld devices. The majority of the studies included in this literature review focused on student behaviors and student learning outcomes, suggesting a need for research focused on teachers. This need is addressed through the focus of the current study on changing the teacher's use of evidence-based classroom management strategies through data-based decision-making, which was facilitated by an electronic data-collection app.

This intervention package was implemented in three phases: (a) a preintervention phase that involved training on data collection and making data-based decisions regarding instructional behaviors (CBSP and providing GOTR to academic instructions); (b) an intervention phase that required participants to use the KIHd system to self-monitor and to receive visual performance feedback, and (c) an intervention phase that required the participants to use the KIHd system to self-monitor, receive visual performance feedback, and to self-evaluation. This study promoted development of three important skills that teachers should exercise: collecting data with a handheld electronic took for data collection, making instructional decisions based on data, and using evidence-based strategies in the classroom.

There are two research questions in this study. The first is, "Is there a functional relationship between the use of the KIHd system (as a self-monitoring device and a means to provide visual performance feedback) and CBSP and GOTR to academic

instructions for special education teachers who work with postsecondary students with intellectual or developmental disabilities?" The two subquestions are: (a) Does the use of the KIHd system affect the rate of CBSP during academic instruction? (2) Does the use of the KIHd system affect the rate of GOTR to academic instructions?

The second research question is "During the intervention in which the KIHd system is used for self-monitoring and visual feedback, if no behavior change is observed among the participant(s), will the addition of self-evaluation create an increase in the CBSP and GOTR to academic instructions for special education teachers who work with postsecondary students with intellectual or developmental disabilities?" The two related subquestions are: (a) Does the use of self-evaluation affect the rate of CBSP during academic instructions? (b) Does the use of self-evaluation affect the rate of GOTR to academic instructions?

Definition of Terms

Applied behavior analysis (ABA). The science that studies the interactions between behavior and the environment.

Contingent behavior specific praise (CBSP). A spoken statement providing positive feedback to the student and specifying the observed behavior. For example, instead of "good job," which is a general praise statement, the observer would say, "I like that you are sitting in your seat," thus clearly describing why the student is being praised.

Evidence-based classroom management strategies. Instructional strategies, interventions, or teaching programs that have resulted in consistent positive outcomes when tested experimentally.

Group opportunities to respond (GOTR). A teacher behavior that evokes gestural, spoken, or written responses from students,

GOTR (gestural). Teacher behavior that results in students raising hands as a group

GOTR (spoken). Teacher behavior that results in students answering an academic request or reading the instructional materials expressively in unison.

GOTR (written). Teacher behavior that results in students answering an academic request with a response card (i.e., writing the response on a dry-erase board or on paper) and then displaying the response to the instructor in unison.

Performance feedback. Information about performance that allows an individual to adjust his or her performance." (Daniels, 1999, p. 101).

Personal digital assistant (PDA). A handheld computer.

Self-monitoring. A person recognizing and recording the occurrence or nonoccurrence of a target behavior using a recording method. For this study teachers used the KIHd system for recording.

Self-evaluation. Comparison of one's own behavior with standards set by oneself or by someone else. For this study, at the end of an intervention session, the participant used a written script to describe what target behaviors occurred during the lesson and if changes in instructions were needed for the next instructional class.

The Kellar Instructional Handheld (KIHd) system: A data-collection app developed by the Hellen A. Kellar Institute for Human disAbilities at George Mason University. This app enables data collection, graph interpretation, and the exporting of data to other computer software for further analysis. For this study participants used the KIHd system to collect data on their own behaviors during instructional time.

Visual performance feedback. A form of performance feedback provided by visual graphs. For this study visual performance feedback was a feature embedded in the KIHd system.

The following chapter provides a literature review that is organized into the following six sections: data-based decision-making in the field of ABA, relating to special education; the use of technological means to assist in data-based decision-making in the field of special education; evidence-based practices in the context of classroom management; different models to promote the use of evidence-based practices in the classroom; self-monitoring strategies in creating behavior changes; and self-evaluation in creating behavior changes in teachers.

CHAPTER TWO

This chapter reviews the existing literature that serves as a foundation for this study. It is written through the lens of ABA with an emphasis on data-based decision-making and evidence-based classroom management strategies in the field of special education. This chapter consists of the following sections: data-based decision-making in the field of ABA relating to special education; the use of technological means to assist data-based decision-making in the field of special education; evidence-based practices in the context of classroom management; different models to promote the implementation of evidence-based practices in the classroom; self-monitoring relating to behavior changes; and self-evaluation relating to behavior changes.

The following databases were used to examine the existing literature regarding data-driven decision-making, the use of evidence-based practices in the classroom, self-monitoring strategies and behavior change, and self-evaluation and creating behavior change: PsycInfo, Eric, Dissertations and Theses: Full Text, Education Research Complete, and Google Scholar. Because of the difficulty of locating articles with the exact key words, journals, including *Journal of Applied Behavior Analysis* and *Behavior Modification,* were searched. The search was limited to peer-review journals published between the 1970s and the 2010s and included a few of the foundational articles relating to the relevant concepts. The population of interest was special education with a few

exceptions for establishing groundwork, making comparisons, and bridging purposes. Keywords used during this search included: self-management, data-based decision-making, data-driven decision-making, data collection, evidence-based classroom management practices, behavior specific praise, OTR, frequent responding in the classroom, performance feedback, visual performance feedback, and self-evaluation.

Data Collection and Data-Based Decision-Making in Special Education

NCLB (2001) and IDEA (2004) both mandated accountability in teaching. For special education teachers this means that teachers should use student data such as assessment data and behavioral data to show student progress in learning and development. Furthermore, instructional decision-making should be supported by data, which ties in closely with the student's IEP. The appropriate use of data-driven decision-making will lead to positive student learning outcomes (Todman & Dugard, 2001).

These laws brought attention to data-driven decision-making and the application of evidence-based practices in the classroom. However, the idea of using data to make instructional decisions is not a new concept, particularly in the field of ABA, which is grounded in data-driven decision-making. A literature review published in 1990 discussed the overall publication trend in behavior analysis in education. Based on this literature review, there were 347 articles on education published from 1968 to 1986 in the *Journal of Applied Behavior Analysis*. Of these articles, 39.4% focused on elementary education, 19.9% focused on special education, and 18.4% focused on general education. The areas of research caterogized from this literature review are classroom conduct (29%), academic skills (25%), language (20%), and skills for instructional personnel such

as teaching (12%). It has been almost thirty years since the publication of this article and there has yet to be another review article focusing on the same topic. However, it is clear that applications of ABA have existed in the field of education, including special education, for many years.

Several educational programs have been developed that are based on the principles of ABA with an emphasis on data-driven decision-making. Precision teaching, the Comprehensive Application of Behavior Analysis to Schooling and the Competent Learner Model are examples of such programs. In these programs, data are used to assess student progress and as a basis for making instructional decisions, leading to better student outcome and program accountability.

Applications of ABA have been widely implemented in special education (Deno, 2003) where the law requires schools and teachers to connect assessment with instruction. However, special education teachers seemed to favor nonsystematic observation versus direct and objective measurements to examine student progress (Potter & Mirkin, 1982). To address the need for objective evaluation of student performance a system called the Curriculum-Based Measurement (CBM) was created based on ABA to allow teachers to evaluate their instructions formatively (Deno, 1985). This system was based on the idea that repeated data are needed to assess the effectiveness of instructions, and formative assessments are needed to examine the effectiveness of instructions.

The effectiveness of CBM has been proven empirically, and its application has expanded from the original formative evaluation to other areas such as screening, evaluation of reintegration and inclusion, and pre-referral evaluation (Deno, 2003; Fuchs,

Fuchs, Hamlett, & Stecker, 1991). It has also been applied to areas outside of special education such as early childhood literacy instructions because of its focus on individualized instruction to meet students' needs (Roehrig, Daggar, Moats, Glover, & Mincey, 2008).

Despite availability of CBM and other data-based educational programs, collecting data continues to be a challenging task for special education teachers; as a result, making data-driven decisions is challenging. According to Roehrig and colleagues (2008), about 50% of the teachers in their study did not use progress data to inform and support instructions. Given this finding, there has been limited research about how data collection and data analyses are taking place in the classrooms (Hojnoski, Caskie, et al., 2009).

In one of the studies that explored the use of data in the classroom, Fuchs and Fuchs (1986) observed teachers in the classroom and found both that they made decisions based on unsystematic observation of the students and that they tended to overestimate student achievement. Grigg et al. (1989) conducted a study and found that, when it comes to making instructional decisions, teachers relied more on the characteristics of students or the conditions in which the data were taken instead of on the graphs they had produced. Furthermore, managing data collection can be difficult (Farlow & Snell, 1989) especially with large student caseloads (Deno, 2003). Balancing teaching and data collection can also be a challenge for teachers, given their other daily duties (McLean et al., 2004). Another challenge for data collection is that not all teachers have the same

level of competency, which kept teachers from making effective instructional decisions (Katsiyannis et al., 2003).

In summary, collecting data and making instructional decisions based on data are familiar practices in special education, especially in programs that are established based on the principle of ABA. However, more investigation is needed to understand the extent to which teachers are collecting and making decisions based on data in the classroom (Hojnoski, Caskie, et al., 2009). Researchers have also discovered barriers to data collection and subsequent analysis, which directly influence data-based decision-making.

The Importance of Data Collection in Special Education

As stated earlier, NCLB (2001) and IDEA (2004) both mandated accountability in teaching for students with disabilities. Data collection is the first step that leads to data-driven decision-making. According to Gunter, Callicott, and Gerber (2003), data collection is the gathering of data in a systematic way to determine whether the student is learning. For this purpose, teachers collect different data such as anecdotal notes, assessment data, and work samples. After data are collected they are then analyzed to be used for intervention, evaluation, and decision-making. Data collection ties in with legal, political, and educational issues relating to the student's IEP, which is required for all special education students in the United States.

Educators and researchers have stressed the importance of data collection as the most crucial element in student and performance evaluation. The foundation for making data-based decisions is data collection, which can assist in monitoring a student's progress, informing instructional decisions, and gaining parents' confidence (Gunter et

al., 2003; Sandall et al., 2004). Data collection can also support the ability to predict a student's future success (Deno, 2003; Jones & Krouse, 1988). Furthermore, teachers who collected data were more likely to make instructional changes (Fuchs et al., 1991) and to improve the quality of IEP objectives (Codding, Skowron, & Pace, 2005).

To examine the above studies in detail, Gunter and colleagues (2003) published a review article that supported the efficacy of data collection in the special education setting. The authors stated that in addition to political and legal reasons, data collection can benefit teachers in several ways. First, teachers who could articulate student goals and use data to monitor student progress gained more confidence from parents. Second, when teachers made instructional decisions based on data, students achieved better learning outcomes. Finally, collecting data was shown to improve the overall quality of the educational programs.

Data collection can assist in the creation of appropriate and observable objectives in students' IEP. Codding, Skowron, and Pace (2005) conducted a study that examined the relationship between curriculum-based measurement data and student objectives. Three teachers who worked with students with acquired brain injury underwent a training package that included modeling, practice, and performance feedback to use data to set objective, measurable, and appropriate goals for students. The efficacy of the training package was examined using a multiple baseline design across teachers. Visual analysis of the data showed that, with the support of data collection, this training package was effective in helping teachers set appropriate objectives for their students.

With respect to evaluating the impact of data collection on student achievement Fuchs and colleagues (1991) examined the effect of curriculum-based measurement and consultation on teacher planning and student achievement in math. Thirty-three teachers who worked with students with low math achievement in 15 schools in a metropolitan area in the southeastern United States participated in this study and were placed in either an experimental or a control group. The curriculum-based measurement called for continuous data collection and decision-making. Teachers in the experimental group received four weeks of curriculum based measurement training, which involved setting goals, measuring student performance, and data-based evaluation. The results of the study showed that teachers who were in the experimental group revised student programs more frequently, and their students had better student achievement. Teachers in this group could also identify what types of problems to teach and what strategies to use.

Furthermore, a study conducted by Jones and Krouse (1998) examined the effectiveness of data-based instruction provided by special education teachers. Similar to the study conducted by Fuchs et al. (1991), this study placed 26 participants in either an experimental group or a control group. Participants in the control group learned about data collection and a data-based problem-solving approach. The results of this study showed that teachers in the experimental group had a greater effect in student reading achievement, and they had greater control of student behaviors such as off-task behavior.

In summary, data are collected in educational settings for legal, political, and educational purposes. Data collection is the foundation for relevant decision-making that can influence student achievement, the frequency of instructional modifications, overall

quality of the educational program, the creation of appropriate IEP objectives, and parents' confidence in teaching.

Barriers to Data Collection in Special Education

The importance of collecting data and making instructional decisions based on data is widely acknowledged. However, there are several barriers that may interrupt data collection and relevant decision-making. One of the few attempts to examine data collection in the classroom was conducted by Sandall and colleagues (2004) in an early childhood special education setting. The participants for this study were seven teachers, five teaching assistants, three speech and language pathologists, and two occupational therapists from a university-affiliated program that provided early intervention to 150 students. This study used surveys, interviews, and reflective writing to examine participants' experiences in collecting data in a classroom environment. The results from this study suggested that the barriers for data collection in the classroom were the nature of the setting, data management, time, and nature of the IEPs.

Nature of the setting refers to the environment in which instruction occurs. Even though the sample size of the study was small, the authors did report that the participants believed that data collection interrupted the flow of teaching and other instructional activities (Sandall et al., 2004). The difficulty in collecting data also increased as the caseload for special education increased.

Data management, the organization of data, is another barrier to data collection. Teachers may lack the skills and knowledge about how to use the data to make data-based decisions (Hojnoski, Gischlar, et al., 2009). There is a shortage of teachers who

are well trained in data collection and data analysis (Shi et al., 2006). In addition, data management can be challenging for special education teachers because of a lack of communication and problems with both data quality and duplication (Sandall et al. 2004).

Time is a major barrier for teachers in collecting data as well as in implementing research-based practices in their teaching (Wesson, King, & Deno, 1984; Yell, Deno, & Marston, 1992). In the study conducted by Wesson and colleagues (1984), 85% of the 300 special education teachers surveyed reported that they were aware of measuring student progress directly and frequently. However, only half of the teachers were familiar with the procedures for doing so. An interesting finding from the study conducted by Yell and colleagues (1992) was that even though it took less than 10% of their instructional time to collect data, teachers believed that they could not incorporate data collection into their schedule. The issue of time required for data collection has become more important as the number of students who receive special education increases every year (Shi et al., 2006). According to Sandall and colleagues (2004), teachers saw data collection as a separate activity requiring extra time. Teachers also reported a feeling of guilt when collecting data because they thought that the time used for collecting data should have been used for instruction.

Finally, Sandall and colleagues (2004) found that participants thought that the IEP did not reflect all of the changes in student behavior in the school and that the goals selected might not be the most relevant for the student. Therefore, teachers believed that data collection related to IEPs focused on low priority skills and behaviors, and they felt constrained by the IEP goals while collecting data. Overall, this study not only

summarized the barriers in data collection for special education teachers, but it also confirmed that teachers' beliefs about data collection may not be reflected in the way they actually collect data. For example, teachers believed that data collection was crucial, but they rarely took data. Furthermore, the data collected were not summarized, analyzed, and presented to team members, thus defeating the goal of using data to make instructional decisions.

Another study conducted by Roehrig and colleagues (2008) examined the use of progress monitoring data in instructional decision-making in a group of kindergarten and first grade teachers and reading coaches. This qualitative study involved use of grounded theory. By conducting in-depth interviews the researchers found two inhibitors for using assessment data to inform instructional data. The first was the time needed to collect data and to individualize instructions and classroom management issues. The second was classroom management issues related to class size and the help that the teachers received, which led to using data to provide individualized support for the students in need.

In summary, the above articles suggest that the barriers to data collection and making data-based decisions are the nature of the setting, difficulties with data management, time, nature of the IEPs, the skills of the individual in collecting and using data to make instructional decisions, and classroom management (Roehrig et al., 2008; Sandall et al., 2004). Furthermore, using data to inform instructional practices seemed to be more difficult than collecting data (Hojnoski, Gischlar, et al., 2009). The report written by Sandall and colleagues (2004) also expressed the need for technical support to integrate data collection into daily activities for students with special needs.

The Use of Technology and Data Collection in Special Education

Using electronic tools to enhance student learning has been emphasized in the field of education, including special education (Anderson & Petch-Hogan, 2001; Edyburn & Gardner, 1999). As mentioned earlier, *technological* has a different meaning in ABA than in other fields. According to Edyburn and Gardner (1999), the term *technological tool* does not simply mean a smaller computer. Instead, this term includes different forms of technology such as portable electronic tools, microcomputers, presentation systems, distance learning systems, video production tools, communication systems, and information retrieval systems. The use of such tools has been proven to enhance student learning as well as create changes in student behaviors (Clarfield & Stoner, 2005; Gulchak, 2008; Kramarski & Zeichner, 2001; Liang & Zhou, 2009; Rich, 2009; Schraw, 2007; Schraw, Crippen, & Hartley, 2006). Technological means have also been shown to be effective in assisting with behavioral procedures such as functional analysis (Carr, Fox, & Vollmer, 2009).

Using technology can enhance learning in the framework of self-regulatory learning such as in math and science education (Kramarski & Zeichner, 2001; Liang & Zhou, 2009). Computer based programs such as Computer-Assisted Cognitive Training and the Attention Training System also improved reading skills (Clarfield & Stoner, 2005) and attention (DuPaul, Guevremont, & Barkley, 1992), and other academic-related behaviors (Christ & Christ 2006; Gulchak, 2008; Rich, 2009). Furthermore, researchers also found that using technology to enhance learning can lead to improved self-regulation (Schraw, 2007; Schraw et al., 2006). However, despite the existence of current literature

in this area researchers such as Xu, Reid, and Steckelberg (2002) called for more research that examines the methodology and the implementations in using technology.

With respect to the use of technology as a self-monitoring tool, in a study conducted by Rich (2009), an assistive technology device called the Watchminder-2 was used as a way to prompt three high school students with attention deficit hyperactivity disorder to self-monitor their on-task behaviors. During the intervention students used this device to self-monitor their on-task behavior using first, a fixed time interval and then a variable time interval. This study suggested an unobtrusive way for students to self-monitor and, as a result, change some task-related behaviors.

In a similar study conducted by Gulchak (2008), the impact of using a handheld computer as a self-monitoring tool was examined on one student with an emotional and behavioral disorder (EBD). In this study, the participant recorded his on-task behavior and graph data at the end of the session on a piece of paper. Both studies mentioned above showed some support for the contention that using a technological device may lead to behavior changes in students with special needs. It is important to keep in mind the methodological limitations of these studies: a paucity of both participants and data points.

Another way that technology can support teachers and students in the classroom is in data collection. According to Sandall and colleagues (2004) there is a need for technical support to assist with data collection for this activity to become a component in daily instructions in a special education environment. As stated earlier, although some teachers do take data to assist in decision-making, some find collecting data a daunting task given their competence in data collection, issues with data management, and heavy

workload. Therefore, technological means may alleviate the challenge in data collection and facilitate the data-driven decision-making process (Shi et al., 2006; Sulser, 2006; Wayman, 2005).

Researchers in the field of education have supported the use of technology in data collection. For example, Wayman (2005) suggested that the use of computer technologies and information management software applications can facilitate the decision-making process. Shi and colleagues (2006) recommended the use of handheld data-collection systems such as smartphone and tablet technologies to support documenting progress and making data-driven instructional decisions. The advantages of using electronic devices to collect data over the traditional paper-and-pencil method include possible faster data-collection time, which may provide teachers with extra time to complete other tasks; higher accuracy in data, faster generation of graphs, and efficient subsequent data analysis. In summary, computer technologies may assist in collecting and managing large amounts of data. These technologies also provide user-friendly interfaces, which allow for data analysis. Through data analysis teachers can make relevant decisions about instructions.

Mandinach and colleagues (2006) suggest that factors that may influence the use of technology for data-driven decision-making are accessibility, length of the feedback loop, comprehensibility, flexibility, alignment, and links to instructions. Accessibility refers to the ease of using a tool. If a tool is difficult to use then teachers will be less likely to use it. Length of feedback loop refers to how quickly the data are received after data collection. Immediate feedback will lead to data-driven decisions being made in a

timely manner. A PDA can be used as a tool to provide immediate information. These devices have been used in clinical research for several decades (Ruf, 2012).

Comprehensibility refers to how the tool presents data to the users in an understandable way to facilitate interpretability such as through graphs and tables. If the output of data is confusing then users will be less likely to exploit these data. A PDA may provide effective outputs for data that enable the facilitation of data-driven decision-making. *Flexibility* refers to how easy it is for users to manipulate the data. The greater the flexibility, the more comprehensible the data may be on an individual level as well as on an aggregated level. Alignment refers to how well the tool matches collected data with the objectives of use. Finally, *links to instructions* refers to how data can inform instructions. A PDA can also be an effective tool in this area.

According to Mandinach and colleagues (2006) the selection of a tool used in data-driven decision-making is a complex task involving factors such as the characteristics of tools, questions to be answered, number of tools needed to answer the intended questions, type of data needed to answer the questions, organization of the data provided by the tool, needs and values of the stakeholders, and the objectives of the users. Therefore, data-driven decision-making is context specific and may be applied on different levels such as in the classrooms, schools, or school districts.

In an attempt to investigate the use of technology in the general education setting, Gentry (2005) examined how technology could assist teachers in decision-making in an Oklahoma elementary school. In this study, the researcher explored the descriptions of a data-driven decision-making process provided by six elementary teachers. Three

categories emerged from the descriptions: the purpose of data-driven decisions, processes of data-driven decision-making, and contextual characteristics of data-driven decision-making. The researcher also found that a major source of information influencing teachers' decision-making came from computer generated data.

In another study, Sulser (2006) explored how mathematics teachers' use of technology for data-driven decision-making affected student achievement. Ten of the 13 AA high schools in Montana participated in this survey study. Five assessment indicators for mathematics students over a two-year period for each of the schools were obtained. Composite scores from the indicators were calculated to correlate with the use of technology for data-based decision-making. The results indicated no statistical differences between the use of technology for data-driven decision-making and student math assessment outcome. Fifty-two percent of the participants used multiple technological tools to assist them in decision-making. Twenty-five percent reported using no technological tools to examine student results. Furthermore, the results indicated that when teachers had a greater capacity for input into design they had greater access to the system. This finding confirmed what Mandinach and colleagues (2006) suggested about creating effective tools to support data-driven decision-making.

A few studies have examined the efficiency of data collection with analogous handheld and paper-based data-collection methods (Fletcher, Erickson, Toomey, & Wagenaar, 2003; Tarbox, Wilke, Findle-Pyles, Bergstrom, & Granpeesheh, 2010). In an observational study that focused on alcohol purchase in a large metropolitan area, Fletcher and colleagues (2003) reported that data could be collected more quickly with

PDAs than with paper and pencil Tarbox and colleagues (2010), however, found that paper-based data collection was only slightly faster than an electronic data-collection method (by 26 s). Despite this difference in findings, these studies found that the electronic data-collection method produced graphs faster than paper-based data-collection methods. Furthermore, the report by Tarbox and colleagues suggested that even though electronic data-collection methods may require more time during instructional time, the time required outside of instructional sessions was shortened.

Several of the above studies were conducted in specific settings such as in a discrete-trial environment for children with autism. Therapists' prior knowledge as well as a history of exposure to paper-based data collection might have contributed to some of the unique findings. Other comparative studies should examine the use of paper-based data collection and electronic data collection in different educational settings with teachers who have no prior knowledge of data collection. Future studies should also examine such data-collection methods in teaching different skills for students with and without autism.

Handheld electronic devices in data collection provide portability and quality improvement and enable data transfer that is more efficient and more accurate than what is possible with the paper-and-pencil method (Songer, Jones, & Parr, 2004). A qualitative study conducted by Churchill and Churchill (2008) examined one teacher's use of a PDA. Results from the interview showed that the PDA can be used as a capture tool, a representational tool, and an analytical tool. In other words, the PDA allows a user to collect information (capture tool), to create knowledge and ideas (representational

tool), and to create graphs and data analysis (analysis tool). There are three important characteristics associated with the incorporation of mobile devices into education: scientific, reflective, and multimedia. Scientific data collection promotes users' knowledge by recording information and providing feedback immediately. Reflective data collection permits recording of behavior in the learning environment that can be later used for reflection. Multimedia data collection may also assist the user in reflecting on the information collected (Patten, Arnedillo Sanchez, & Tangney, 2006).

Given that handheld electronic devices such as PDAs or mobile smartphones may collect data, present data, and analyze data with accuracy and immediacy, future investigation is needed to examine the likelihood of teachers using such tools for data collection compared with the likelihood of their using paper-based data collection. Furthermore, more studies should be conducted to examine the effects of data-collection training in promoting data collection in the classroom setting.

The KIHd System

The NCLB and IDEA data-based decision-making requirements have led to the creation of data-collection systems to monitor student performance and achievement to provide evidence for student performance and progress. The KIHd system was originally a PDA-based internet data-collection tool created to help teachers and parents gather behavioral data more effectively than they could with paper and pencil. With the creation and proliferation of smartphones, a KIHd system app was created with features similar to those of the handheld version.

The KIHd system can be used to collect real-time data on student behavior at the individual level with a self-generated graphing feature, which can provide immediate feedback for users such as teachers, parents, or other educators to use in making relevant decisions about instructions. This tool saves time, which allows educators to engage in other work-related tasks. Users can collect data on one or several students. Data can then be analyzed at the individual level or in an aggregated format by exporting data into a statistical analysis tool such as Microsoft Excel or SPSS. This system meets requirements of accessibility, length of the feedback loop, comprehensibility, flexibility, alignment, and links to instructions, which are essential for technological tools to work effectively (Mandinach, 2006).

One of the theoretical foundations for the KIHd system is the single-subject research design, a commonly used research design in special education. Single-subject research design focuses on measuring behaviors with observable outcome variables. Time series data analysis involves collecting multiple data points over time and across different settings. This type of data collection addresses the heterogeneity in abilities and needs among special education students where large-scale assessments may not be accurate in reflecting their individual level of performance and progress. Time series data analysis also focuses on visual analysis of level, trend, variability, and overlap of the data, which represent the magnitude of change in behavior as well as the rate of change in behavior. Single-subject research design can not only guide educators in helping students with special needs in their educational journey, but can also extend educational research

and practices such as addressing causal relationships between behavior and independent variables with both internal and external validity (Horner et al., 2005).

Another theoretical foundation of the KIHd system that is different from other data-collection systems is ABA, which is the science that examines the relationship between behavior and observable environmental variables. The defining characteristics of ABA are that it is applied, behavioral, analytical, effective, generality, technological, and conceptually systematic (Baer et al., 1968). With decades of empirical support, the principles of ABA can lead to socially significant changes in behavior such as decreasing inappropriate behavior and increasing appropriate behavior. Even though the principles of ABA can be applied to any situations where behaviors exist, they have been demonstrated to be effective in instructions and behavioral interventions for individuals with disabilities (Harris & Delmolino, 2002). ABA stresses the importance of using operationalized definitions for behaviors as the initial stage for implementing any strategies for creating behavioral changes. ABA also places great emphasis on data collection as well as making decisions based on data.

Data collection includes direct and indirect measurements of behavior, which are both considered and captured by the KIHd system. Direct measurements of data include frequency (how many times), duration (how long), inter-response time (how much time between responses), and latency (how much time between a change in instructions or other stimulus and a response). Indirect measurements of behavior include time sampling, fluency, and accuracy. Different data-collection methods may answer different questions that a teacher may have about students' academic and social behaviors.

Through analysis of data, teachers may alter instructions or change environmental factors to support students in the classroom.

Traditionally, data has been collected using paper and pencil. This data-collection method is not only time consuming but also lacks a standard format. Data must be transposed onto a graph as a separate task. The KIHd system was created to resolve this issue and to assist teachers and parents of children with special needs in making data-driven decisions regarding instructional strategies. The KIHd system is a computerized application that supports the practice of real-time data collection, that is, the data are collected and graphed simultaneously. The original KIHd system has two components: a PDA and a personal computer. The data entered in the PDA can be transmitted to the personal computer immediately after data collection; this data can then be further analyzed with Microsoft Excel. A PDA can be a smartphone or a tablet. The KIHd development team has created a smartphone app, which was used in the present study. The app replaces the PDA, and analysis can be completed on the smartphone or computer.

Development of the KIHd system required several years and involved several usability tests. The KIHd prototype was created in 2004 after George Mason University faculty and students had conducted performance and need analyses. Between 2006 and 2008 researchers from George Mason University received a technology grant from the U.S. Department of Education Stepping Stones Project (H327A06003) to investigate teachers' use of the KIHd system in a metropolitan school. The three aims for this project were: testing the effectiveness in assisting teachers in making data-driven

decisions, examining teachers' use of data in activity planning and providing insight into activities foregone because of a lack of time during instructions, and evaluating teachers' perception about this data-collection system. The results of this project suggested that the KIHd system was easy to navigate, easy to use to make educational decisions, and could help teachers collect data on a variety of student behaviors.

As mentioned earlier in this paper, there has been a growth in the use of technology for data collection to assist data-driven decision-making, specifically in wireless data-collection software and apps over the past several decades (Shi et al., 2006; Wayman, 2005). For example, computer software such as the Discrete Trial Trainer by Accelerations Educational Software, Learner Profile by Sunburst, and the Behavioral Evaluation Strategy and Taxonomy from Scolari were all created to collect observational data. Smartphone-compatible apps, such as the Behavior Tracker Pro, D.A.T.A., Behavior Snap, and ABC Data Pro, have also been created for data collection. Even though computer software and apps are available to collect data, some can be difficult for teachers to use because of the app's complexity, the level of programming involved, the number of features included, and the price of the software and apps.

In summary, the KIHd system is a user-friendly tool for educators and parents to use to collect data on student behavior and performance. It can collect data in the form of frequency, duration, accuracy, and fluency. After the data are input they can be immediately converted into graphs; this instantaneous availability of data can assist teachers in making instructional decisions and answer a variety of questions about student behavior and performance. The KIHd system is currently licensed to ADeeperview.com.

This system is unique in its kind because of the flexibility in programming it offers as well as the framework on which it was built, ABA. Because there has been only limited research on teachers' use of a data-collection system to monitor their own instructional behaviors, this topic became the focus of the current study.

Evidence-Based Classroom Management Strategies

Classroom management is a skill that preservice and in-service teachers must use to achieve optimal teaching and student learning outcomes (Emmer & Stough, 2001). According to Walker et al. (2004), classroom management comprises "actions that teachers engage in to enhance the probability that children will develop effective behaviors that are personally fulfilling, productive, and socially acceptable" (p. 7). The APA conducted a Teacher Needs Survey from 2005 through 2006 in which 2,334 teachers from 49 states and the District of Columbia participated in an online survey. The results showed that 52% of first-year teachers, 28% of teachers with two to five years of teaching experience, and 26% of teachers with six to 10 years of teaching experience reported classroom management as the area where they most needed improvement (Coalition for Psychology in School and Education, 2006). Adequate classroom management is crucial for general classrooms as well as special education classrooms.

According to Sugai and Horner (2006), classroom management should address three areas: maximized allocation of time for instructions, arrangement of instructional activities to maximize academic engagement and achievement, and proactive behavior management practices. Existing literature shows that teachers' classroom management skills correlate with student achievement (Wang et al., 1997) and allow for learning to

occur (Oliver & Reschly, 2007). A deficiency in classroom management skills may lead to a decrease in learning opportunities caused by an increase in problematic behavior (Wagner et al., 2005). When managing a classroom, it is important for the teacher to use evidence-based practices to ensure that time for instructions is maximized, academic engagement and achievement are maximized, and problematic behavior is reduced.

NCLB and IDEA both mandated the use of practices and programs with scientific validation; this requirement promoted the development and use of the term *evidence-based practices*. It is believed that evidence-based practices will lead to better student outcomes (Kutash & Duchnowski, 2006). An evidence-based practice can be defined as an instructional strategy, intervention, or teaching program that results in consistent positive outcomes when tested experimentally (Mesibov & Shea, 2011; Simpson, 2005). As recognized by most organizations, an evidence-based practice is validated by first, a sound experimental or evaluation design and appropriate analytical procedure; second, empirical validation of effects; third, clear implementation procedures; fourth, replication of outcomes across implementation sites; and fifth, evidence of sustainability (Kerr & Nelson, 2006).

Based on these criteria Simonsen and colleagues (2008) conducted a literature review on existing evidence-based practices for classroom management and identified 20 practices with scientific support. These strategies fall into five groups: (a) maximizing structure; (b) posting, teaching, reviewing, monitoring, and reinforcing expectations; (c) actively engaging students in observable ways; (d) using a continuum of strategies for

responding to appropriate behaviors; (e) using a continuum of strategies to respond to inappropriate behaviors.

Maximizing structure refers to maximizing the number of teacher-directed activities, the number of routines that are defined for the students, and the physical arrangement of the classroom. Direct activities, routines, and arrangements in the physical environment have all been shown to lead to a decrease in inappropriate behavior and an increase in the students' social and academic involvement (Huston-Stein, Friedrich-Cover, & Susman, 1977; Morrison, 1979).

Posting, teaching, reviewing, monitoring, and *reinforcing expectations* means to explicitly explain expectations to the students and post the written expectations where they are clearly visible. After teaching and reviewing with the students, the teachers provide reinforcement for student behaviors that are consistent with the stated expectations. This process results in a decrease in off-task and disruptive behavior as well as an increase in engagement, leadership, and the ability to resolve conflict (Johnson, Stoner, & Green, 1996; Lane, Wehby, & Menzies, 2003; Lo, Loe & Cartledge, 2002).

Actively engaging students in observable ways refers to how much the students participate in classroom instructions including both active behaviors (such as answering questions) and passive behaviors (such as listening to the teacher). When students are engaged in the lesson they are less likely to engage in behaviors that may be undesirable. Some examples of ways to engage students are: frequent OTR, direct instructions, classwide peer tutoring, computer-assisted instructions, and guided notes. Researchers

have found that the use of these strategies led to an increase in on-task behavior and number of correct responses produced (Sutherland, Alder, & Gunter, 2003), academic engagement (Carnine, 1976), and academic achievement (Austin, Lee, Thibeault, Carr, & Bailey, 2002).

Using a continuum of strategies for responding to appropriate behaviors emphasizes identifying, recognizing, and encouraging desirable behaviors in the classroom. Using specific and contingent praise, group reinforcement contingencies, behavior contracts, and token economies are examples of such practices. Researchers have found that the use of specific and contingent praise increased correct responses (Sutherland & Wehby, 2001), work accuracy, productivity (Craft, Alber, & Heward, 1998), and compliance (Wilcox, Newman, & Pitchford, 1988). Group contingencies and token economies increase positive verbal exchanges among students (Hansen & Lignugaris-Kraft, 2005) and decreased inappropriate behavior such as out-of-seat behavior (Barrish, Saunders, & Wolf, 1969). Behavioral contracts increased student productivity and promoted on-task behavior (Kelley & Stokes, 1984; White-Blackburn, Semb, & Semb, 1977).

Using a continuum of strategies to respond to inappropriate behaviors means reacting to undesirable behaviors when they occur. Contingent and specific error correction, performance feedback, differential reinforcement, planned ignoring, response cost, and time-out from reinforcement are examples of such practices. These practices led to an increase in appropriate behavior (Winett & Vachon, 1974) and a decrease in inappropriate behavior (Brantley & Webster, 1993; Deitz, Repp, & Deitz, 1976).

The current study selected CBSP and GOTR to academic instructions as the target behaviors. These two target strategies were chosen by the researcher after an initial observation was conducted in the classrooms where this intervention took place and on the basis of the standards used in a study conducted by Simonsen and colleagues (2013). The standards are: first, an operational definition of terms that describes the behavior in an observable and measurable way; second, objective observations that can be performed on the behavior chosen; and finally, changes in behavior that must occur at a high enough frequency so that change can be detected and measured. Even though there are other strategies that meet these criteria, CBSP and GOTR to academic instructions were appropriate for this present study.

Contingent Behavior Specific Praise

Teacher praise is a nonintrusive and natural consequence that a teacher may provide to students, and it has been shown to be effective in classroom management (Beaman & Wheldall, 2000; Richardson & Shupe, 2003). Delivering CBSP may also lead to an increase in task engagement and a decrease in inappropriate behavior (Gorman-Smith, 2003; Sutherland et al., 2000). Given the effectiveness of praise, it is surprising that it is not used more often in the classroom. Researchers have found that the average number of praise statements used in the classroom ranged from 4.4 praise statements per hour in an EBD and learning disabilities classroom (Gable, Hendrickson, Young, Shores, & Stowitschek, 1983) to one praise statement for every 20 reprimands among students at high risk for aggression (Wehby, Symons, & Shores, 1995). With this

in mind, researchers have looked into the types of praise that are effective and how to promote the use of praise in the classroom.

Brophy (1981) and Chalk and Bizo (2004) stated that teacher praise was more effective when it described the behavior for which it was being delivered. On the basis of the description of behavior they are given, students can recognize which behavior is desirable and so enhance the connection between desirable behavior and its positive consequence. For example, "good job" is a general praise statement, whereas "great putting the book away," is a CBSP statement. Even though CBSP is an evidence-based practice, its classroom use has not been consistent; consequently, researchers have explored ways to promote and to maintain its use in the classroom.

Strategies researchers have found to be effective in promoting the use of CBSP include: prompting and self-monitoring (Sprick, 1981) and videotaped self-monitoring (Lago-Delello, 1998). Receiving feedback from supervisors enabled preservice teachers to recognize and to use praise, which also increased these teachers' satisfaction with their own performance (Rathel et al., 2008).

Reinke, Lewis-Palmer, & Martin (2007) examined the effect of visual performance feedback on the use of CBSP by three general classroom teachers. As part of the intervention the teachers were given a visual graph indicating the frequency of CBSP use. The results showed that even though use increased during the intervention this effect was not maintained during the follow-up examination when visual performance feedback was withdrawn. This decrease in CBSP during the maintenance phase also occurred in the following study.

In this study, conducted by Sutherland and colleagues (2000), researchers examined teachers' use of observation performance feedback intervention among students with EBD. The intervention included explaining the importance of using CBSP, goal setting, giving prelesson reminders, and delivering praise after the lesson. During the intervention there was an increase in use of CBSP. However, use decreased when the intervention components were removed. Clearly, the phenomenon of sustainability of the intervention is worth investigating and this area was, therefore, chosen for examination in in the present study.

Opportunity to Respond

As mentioned earlier in this paper OTR is a teacher behavior that provides an instructional situation to which students can respond. Some of the ways that a teacher may provide such OTR are: asking a question for students to answer (spoken), asking students to raise their hands if they agree or disagree with a statement or comment (gestural), or asking students to write a response (written). Two common methods used to increase the rate of presenting OTR in a classroom setting are response cards and choral responding. Using response cards means that all students write the answer to a question on a board or paper and present the answer to the teachers at the same time by raising the boards or paper. Choral responding means that the whole class answers the teacher's questions in unison.

Research has shown that providing OTR influenced student behavior and academic performance. For instance, providing OTR led to a decrease in inappropriate behavior (Sutherland et al., 2003), an increase in on-task behavior and academic

engagement, and an increase in the number of correct responses (Sutherland et al., 2003; Sutherland & Wehby, 2001). Use of choral responding increased academic achievement (Sindelar, Bursuck, & Halle, 1986) and on-task behavior (Godfrey, Grisham-Brown, & Schuster, 2003). Use of response cards increased on-task behavior and the level of responding (Lambert, Cartledge, Lo, & Heward, 2006). Even though the rate of OTR directly correlates to student learning, its implementation is not consistent across different learning environments (Stichter et al., 2009).

Some approaches that promote OTR include direct instructions, classwide peer tutoring, computer-assisted instructions, and the use of guided notes. Researchers have also investigated particular strategies to increase the use of OTR. Simonsen, Myers, and DeLuca (2010) conducted a study involving three teachers in a public alternative school serving students with high incidence disabilities. They examined the effect of providing explicit training and performance feedback on the use of evidence-base strategies, including prompts, OTR, and CBSP. They found that there was no functional relationship between explicit training and the use of these practices. However, providing performance feedback created a change in teachers' behaviors.

The present study investigated the effect of GOTR, a teacher behavior that evokes gestural (e.g., hand raising), spoken (e.g., choral responding), or written responses (e.g., response cards) from students.

The Research-to-Practice Gap

Even though evidence-based practices for classroom management have been identified, the implementation of such practices in educational settings has not been

consistent (Cook, Landrum, Tankersley, & Kauffman, 2003). This lack of implementation has been referred to as "the research-to-practice gap," and it occurs in general education as well as in special education classrooms (Cook & Odom, 2013). There is limited research that examines the reasons behind such a gap. Despite attempts to close this gap, it continues to be an area of concern in special education (Burns & Ysseldyke, 2009).

One attempt to examine the reasons behind the research-to-practice gap, from the perspectives of teachers, was made by Gaughan (2008). This study used a mixed-method research design, which included an online survey and follow-up interviews. The researcher identified these barriers leading to a failure to implement evidence-based strategies: lack of membership in a professional organization; lack of knowledge about and access to resources in the district; and, most importantly, time. The importance of time as a barrier was influenced by factors such as an increase in the caseload, the amount of paperwork, continuing education, family responsibilities, and the emotional toll of working with student with special needs. To address this issue of time, the current study has endeavored to provide a strategy for teachers to increase their use of evidence-based practices during teaching without interfering with engagements outside of teaching.

Bradley-Black (2013) conducted a study during one teaching day in which she examined the understanding of and use of evidence-based practices by both general education and special education teachers. A national sample was selected via the Internet from which teachers were selected to participate in a survey. Results showed that general education and special education teachers had similar sources of knowledge,

perceptions of use, and reported barriers regarding evidence-based practices. Furthermore, teachers depended on local school districts and their own schools for obtaining information about evidence-based practices. Finally, when asked to provide definitions for evidence-based practices, there was a lack of understanding about important elements of evidence-based practices. Contrary to Gaughan's report (2008) Bradley-Black's six follow-up interviews mentioned no barriers in implementing evidence-based practices. On the basis of these results the researcher called for meaningful professional development opportunities for teachers, explicit instructions, and immediate feedback for implementing evidence-based strategies.

Over the past decades researchers have examined different ways to improve implementation of evidence-based practices. For example, researchers have investigated the use of training, coaching, self-management tactics, performance feedback, mentoring, and consultation as well as the role of each of these approaches in promoting the use of evidence-based strategies in classroom management. The generally accepted view is that training alone does not change a teacher's behavior (Fixsen et al., 2005). Based on past research the current study examined the use of an electronic device in assisting implementation of evidence-based classroom management practices.

Self-Monitoring and Behavior Change

In the field of ABA, self-management is seen as a behavior that is influenced by environmental factors instead of a theoretical construct that is described in the context of self-regulation. Researchers from other disciplines have developed different models to describe self-management. In an article published in 2012 by MacKenzie, Mezo, and

Francis (2012) reported on existing models of self-regulation and found that there were 42 theories relating to self-regulation, encompassing concepts of self-monitoring, self-evaluation, and self-reinforcement.

Self-management is a term that describes the process of a person managing his or her own behavior (Simonsen et al., 2013). B. F. Skinner is cited as the first person to describe this concept by connecting it to operant behavior, calling it "self-control" (1953). Operant behaviors are behaviors that are controlled by their consequences. Self-management is the act of applying principles of behavior to oneself (Kazdin, 1975) by manipulating the antecedents and consequences variables to alter the occurrence of the behavior in the future.

B. F. Skinner (1953) stated that people manage their own behavior similarly to how they manage the behavior of others. Cooper et al. (2007) defined self-management as "the personal application of behavior change tactics that produce a desired change in behavior" (p. 704). Through self-management the desirable behaviors of an individual will occur more frequently while undesirable behavior will occur less frequently. Self-management techniques may also mediate differences in reinforcement across settings over a long period of time, leading to maintenance and generalization of behavior change (Baer, Holman, Stokes, & Fowler, 1981).

Other researchers have incorporated the idea of previous understanding in their self-regulation models. For example, Kanfer (1970) suggested a multistage model for self-regulation, which is composed of self-monitoring, self-evaluation, and self-reinforcement. The above concepts can be incorporated alone or in combination to create

behavior change in students and in teachers. The possibility for teachers to manage their own behaviors may reduce their reliance on others, such as supervisors or trainers, to improve teaching practices. Researchers King-Sears and Carpenter (1997) stated that, self-management is a process composed of self-monitoring, self-evaluation, and reinforcement of one's own behavior. Self-monitoring involves a person recognizing and recording the occurrence or nonoccurrence of a target behavior using a recording method; this approach is often used in combination with goal setting and self-evaluation. Self-evaluation is judging one's performance with a standard. Self-reinforcement is accessing a chosen reward when performance reaches a predetermined level.

Self-monitoring has been found to change behavior by either improving or adversely affecting the behavior in children with disabilities. Research has shown that self-monitoring increased students' preparedness for class (Creel et al., 2006), decreased the occurrence of inappropriate behavior in the classroom (Webber et al., 1993), increased attending to tasks and academic accuracy (Holifield et al., 2010), and increased on-task behavior (Anderson & Wheldall, 2003; Gulchak, 2008). These studies are explored further below.

Creel and colleagues (2006) investigated the use of self-monitoring and preparedness for class among middle school students with attention deficit hyperactivity disorder (ADHD). Four students in a language arts resource classroom participated in the study. After the researchers had collected baseline data, students used a seven-item classroom-preparedness checklist to track their own behaviors ("yes" or "no" for compliance). When participants had mastered all items on the checklist, maintenance

data were taken once a week for two weeks. Results showed that self-monitoring through self-recording was effective in increasing classroom-preparedness skills for all participants in the study.

To assess the use of self-mentoring strategies in creating student behavior during instructions Holifield et al. (2010) conducted a study with two students with autism to examine the effect of self-monitoring on attending to a task and academic accuracy. Five behaviors met the operational definition of attending to task: reading aloud, writing on a worksheet, erasing an answer, following a teacher's directions, and asking or answering a task-related question. Academic accuracy was defined as the number of items completed correctly, divided by the number of items given, and then multiplied by 100%. During the intervention, both students received reminders every five minutes to reflect on their behavior and then to record "yes" or "no" on a self-recording sheet created by the teacher. The results of the study suggested that both students experienced an immediate increase in attending to tasks during the intervention. However, the impact on academic accuracy varied between the two students.

The above studies investigated the effects of self-monitoring strategies with a paper-and-pencil format. To examine a different recording method Gulchak (2008) investigated the use of a mobile, handheld computer as a self-monitoring tool to help a student stay on task. This study used an AB withdrawal research design, which included a baseline phase and an intervention phase. After the baseline phase, the participant received training to identify the differences between on-task and off-task behavior. The participant also learned to use the mobile device to record data on his own behavior.

During the intervention an alarm clock was set for 10-min intervals. When the timer went off the student recorded his behavior on the mobile device. The results of the study showed that this participant responded positively to the intervention. Furthermore, results showed that this student learned to use mobile device as a tool for self-monitoring. This study, however, did not include a maintenance phase to examine the sustainability of the intervention. Because the sample size was only one participant, generalization to the larger population is difficult.

Another study conducted by Anderson and Wheldall (2003) examined the relationship between self-monitoring and on-task behavior using an electronic device called Watchminder. Three students participated in this study where they used the Watchminder to self-monitor and a booklet to self-record. The results of the study showed that two of the three participants experienced significant improvement in on-task behaviors.

The above studies demonstrate that self-monitoring strategies may incorporate different recording forms such as paper-and-pencil, mobile phone, and paper checklists for tasks. The commonality across the studies is the use of single-subject research design to monitor the change within the individual. Because of the choice in intervention design, more replications are needed across multiple participants and multiple settings to test for generalization of the results to the larger population.

In addition to investigating the effects of self-monitoring strategies in student behavior, researchers have investigated its impact on teachers' use of teaching strategies and skills. For example, Belfiore, Fritts, and Herman (2008) examined the use of video

in improving a teacher's delivery of five-step discrete trial instructions. In this study, all three participants increased the accuracy of delivery of discrete trial instructions by going through this intervention, which involved watching a video recording of their teaching sessions and evaluating their own performances. This study found that self-monitoring through video was an effective method to improve accurate delivery of discrete trial training.

Another study conducted by Petscher and Bailey (2006) examined the effects of training, prompting, and self-monitoring on staff behaviors including managing disruptive behavior, delivering bonus points and praise, and prompting appropriate behavior. This intervention was evaluated using a multiple-baseline across behaviors design. The intervention package created positive changes in behavior for each of the three teachers, indicating that self-monitoring and feedback on accuracy were effective strategies in improving the three target behaviors.

Self-monitoring strategies have been used to improve teachers' data-based decision-making (Allinder, Bolling, Oats, & Gagnon, 2000; Browder, Liberty, Heller, & D'Huyevetters, 1986). Browder and colleagues (1986) examined the use of self-monitoring and self-evaluation on teachers' instructional decision-making. This study involved three teachers who were trained to self-monitor instructional decision-making and self-evaluate using a decision guideline provided by the researcher. During this study teachers learned to use a checklist to examine student data and then to make decisions based on the data trend. Examples of decisions made were moving to the next step in instructions, task analyzing the response, moving forward to the next step and

reviewing the next step, or providing better consequences for better performance. This intervention created immediate changes in teachers' trend estimation through self-recording, self-evaluation, and rule-following decisions. However, the way in which change was evaluated is a limitation of this study: the effect of the intervention was evaluated by teacher reports instead of direct measurement of teachers' behaviors. In response to this limitation, the current study included a direct measurement of teachers' behavior changes."

The use of self-monitoring in data-based decision-making was further explored by Allinder and colleagues (2000). Their study examined the effect of using a combination of self-monitoring and curriculum-based measurements in mathematical computations with three groups of special education teachers (control, curriculum-based measurement only, and curriculum-based with self-monitoring). The self-monitoring strategy focused on guiding teaches in data analysis for student progress. Results showed that teachers who learned to self-monitor revised their instructional plans differently than did teachers from the other two groups; the self-monitoring group showed more growth for students than did the other groups. This study suggested that self-monitoring may create positive behavior change in teachers after instructional time; in contrast, the current study aimed to examine the impact of self-monitoring during academic instructions.

Self-monitoring strategies have also been used to increase use of specific classroom management strategies, such as CBSP and OTR. For example, Kalis et al. (2007) used self-monitoring to increase one teacher's use of praise statements. During

the intervention, the teacher tallied each occurrence of praise with a handheld counter. This intervention led to an immediate increase in the number of praise statements from 1.75 instances in 10 min to 21 instances in 10 min. The intervention effect continued through the maintenance phase, which showed the sustainability of the intervention. This intervention was successful; however, as only one teacher participated it is difficult to generalize the findings to the larger population. The design of the study was a simple AB withdrawal design, which did not permit demonstration of a strong functional relationship between the variables.

Self-monitoring strategies applied after the behaviors had occurred were investigated with technological tools such as video recording. For instance, Hager (2012) examined the use of self-monitoring, teacher's use of praise, and OTR for one teacher through videotaped instructional sessions. Hager found videotaping to be effective. During this intervention the teacher video recorded her own teaching session for 10 min and then watched the video clip after the teaching session was over. The teacher calculated her use of praise statements and OTR and then graphed this data on paper. Similar to what has been demonstrated in previous findings, this intervention created an immediate change in behavior.

Similar to Hager's (2012) study, the impact of using audiotape to self-monitor has been examined. For example, Partin, Robertson, Maggin, Oliver, and Wehby (2010) explored the use of self-monitoring in promoting CBSP and OTR. During this intervention, teachers self-monitored how often they delivered praise statements and provided OTR once a week for approximately 15 weeks. The teachers first received

training on the importance of using CBSP and providing OTR. Then teachers learned about self-monitoring, which involved audiotaping their teaching lessons, meeting with a consultant to listen to the tape while tallying the number of occurrences of CBSP and OTR, and calculating the rate for each of the behaviors. In this study, the performance of one teacher was shared with the readers. However, the number of teachers who participated in this study is unknown. In this study, self-monitoring occurred after instructions instead of during instructions.

To identify the most effective self-monitoring strategy to increase teachers' use of CBSP in the classroom, Simonsen and colleagues (2013) conducted a study using three methods for self-recording: tally, count, and rate. *Tally* means that the teacher recorded every instance of CBSP on paper. *Count* means that the teacher recorded each occurrence of CBSP by pressing a button on a golf counter. *Rate* means that the teacher estimated the rate of CBSP use on a scale of 0 to 4 times per minute. Results showed that all five participants displayed an increase in delivery of CBSP but at a different rate, which suggested that self-monitoring was an effective strategy. All teachers preferred the count method for self-monitoring. Three of the five teachers participated in a performance feedback phase because of variability in data. During this phase the researcher provided spoken and graphic information to the teacher about his or her use of CBSP. The addition of this phase did not produce an increase in CBSP for all teachers, which suggested that performance feedback may or may not facilitate the use of this practice. A recording method that was not examined in this study was interval recording, which was selected for the present study. Interval recording requires participants to self-

record after each set period of time; this approach reduces the demand to record every instance of behavior. For this study, it was hypothesized that interval recording would also lead to an increase in the teachers' use of CBSP and provide more GOTR to academic instructions with social validity.

For self-monitoring to be effective there are a few considerations to keep in mind. First, the target behavior should be operationally defined so teachers and the data collector(s) are clear about which observable behavior(s) to focus on. Second, there should be a dimension of behavior that is being measured during the intervention. For example, if the goal is to increase the occurrence of a behavior then a frequency count of that behavior should be used. Third, generalization should be taken into account when designing the intervention so that behavior change can be detected in the natural environment over time, such as in the classrooms (Lylo, 2011). Using self-monitoring strategies to increase teachers' use of evidence-based classroom management practices has been proven to be effective. However, because no studies have yet examined the effect of using an electronic data-collection app as a tool for self-monitoring in creating behavior change in teachers who work in a postsecondary special education setting, this topic was chosen for the current study.

Performance Feedback and Behavior Change

Performance feedback is defined as "information about performance that allows an individual to adjust his or her performance" (Daniels, 1999, p. 101). In the field of education, performance feedback is an evidence-based practice that has been used to improve student behavior, teaching practices (L'Allier et al., 2010; Mortenson & Witt,

1998), and treatment integrity (Solomon, Klein, & Politylo, 2012). The objective for providing performance feedback is to improve the target behavior(s) measured by the observer or the performance analyst. It is believed that when compared with providing training or with providing incentives alone, the use of performance feedback may produce optimal changes in behavior (Fixsen et al., 2005).

Solomon et al. (2012) conducted a meta-analysis to examine the effect of implementing performance feedback in treatment integrity. This study analyzed results from 36 peer-reviewed single-case studies involving 127 participants. The results of this study indicated that performance feedback was an effective approach for creating behavior change in teachers during academic interventions or behavioral interventions. Outside consultants were used to provide performance feedback for 88% of these 36 studies. Furthermore, findings also suggested that the immediacy of performance feedback may influence the effectiveness of this support model. The current study took the immediacy effect into consideration as the KIHd system provides immediate visual feedback to the participants during the intervention.

In the study conducted by Myers, Simonsen, and Sugai (2011) the researchers examined the effects of providing performance feedback to four middle school teachers on their delivery of praise statements. During this intervention, three tiers of support were provided based on the change in use of praise statements. This intervention was shown to be effective for all participants even though not all of them required all three tiers of support. On the basis of these findings it was concluded that merely exposing participants to information was not adequate to change their behavior in the delivery of

praise statements. Teachers may require different levels of professional development support to maintain the target skills obtained. This study also found that change in teaching practice resulted in more on-task behavior and less disruptive behaviors from the students.

The effects of performance feedback in CBSP and OTR were further understood by Cavanaugh (2013) in a literature review article. Findings from the review suggest that performance feedback may be an effective approach for improving teachers' use of praise with or without a training component on the target behavior. The effect of using performance feedback for OTR is less clear than for CBSP. Thirty-three articles included in this review showed that performance feedback was delivered by a variety of methods, such as graphs (Colvin et al., 2009; Rathel et al., 2008), written feedback (Hemmeter et al., 2011), and performance in conjunction with goal setting (Kalis et al., 2007).

Reinke and colleagues (2007) examined the use of visual performance feedback on teachers' use of CBSP. Unlike other types of performance feedback, which are often provided by a consultant, visual performance feedback did not require a consultation meeting. During the intervention, three teachers were given a visual graph indicating the frequency of CBSP delivered during teaching. The results show that after visual performance feedback all three teachers increased CBSP delivery. However, even though there was an increase in CBSP delivery during the intervention, this effect was not maintained during the follow-up examination when visual performance feedback was withdrawn. This study suggested that visual performance feedback alone might not create a sustainable change in behavior.

Burke, Howard, Peterson, Peterson, & Allen (2012) also examined the use of visual performance feedback on targeted and nontargeted staff's use of CBSP. Unlike other studies where data were taken by researchers, the teachers and their aides collected data in this study. Four teachers participated in this study. During this intervention teachers took data on the number of CBSP statements provided by the aides. Then the teachers gave the data to the supervisor to be plotted on a cumulative graph. The supervisor then gave the graphs to the teacher aides without any discussion. This study used a multiple-based research design with a reversal phase. The results indicated that both teachers and teacher aides improved in their use of CBSP. This increase was more noticeable for the teachers who took the data. During the maintenance phase, however, the teachers showed variability in the use of CBSP. Two teachers experienced a decrease in CBSP, but their use was still higher than in the initial baseline. One teacher increased her use of CBSP. One teacher remained the same between the intervention phase and maintenance phase.

In summary, performance feedback may involve a variety of formats, and it has led to behavior change in teachers working in different settings across different grade levels. An important learning from these studies is the importance of the immediacy of the feedback when attempting to create behavior change; this subject should be investigated further. More immediate feedback may lead to a more significant effect on desirable behavior change (Solomon et al., 2012). Furthermore, the use of a visual supplement led to more behavior changes than with spoken feedback alone. At this point, it is unclear which method of performance feedback is the most effective. More

information is also needed about the environment in which performance feedback is given to achieve optimal results in behavior change.

Among the existing studies involving the use of visual performance feedback, this method of performance feedback was either used with other methods such as self-modeling (Hawkins & Heflin, 2011) or was provided by the interventionist (Reinke et al., 2007). None of the studies used visual performance feedback generated by the participants alone. In the current study, visual performance feedback was included as a component of the intervention package to examine its effectiveness in supporting the use of evidence-based practices including CBSP and GOTR to academic instructions.

Self-Evaluation and Behavior Change

According to King-Sears and Carpenter (1997) self-evaluation is the comparison of one's own behavior with standards set by oneself or by someone else. Based on this comparison an individual can make judgments about his or her own performance. Self-evaluation is also referred to as self-assessment, and it usually follows self-monitoring of behavior and self-reinforcement. Self-evaluation is an important skill that allows an individual to be a competent problem solver. Self-evaluation and self-recording are sometimes seen as a components of self-monitoring (Kanfer, 1970) and has been used to create changes in teachers' instructional practices (Keller & Brady, 2005) and student performance (Trammel, Schloss, & Alper, 1994).

Several studies have evaluated the impact of self-evaluation combined with other self-management strategies in creating behavior change in students and teachers (Browder et al., 1986; Keller & Brady, 2005; Spates & Kanfer, 1977). In the study

conducted by Spates and Kanfer (1977) the effect of using self-monitoring, self-evaluation including criterion setting, and self-reinforcement altogether in a package was examined with 45 first-grade students who were solving math problems. The participants were divided into five groups: (a) control, (b) self-monitoring, (c) criterion-setting, (d) self-monitoring and criterion, and (e) self-evaluation and self-reinforcement. This study used a pretest posttest control group design. The results from the Tukey's multiple comparisons test indicated that the most critical component in improving math skills is criterion setting. Any training package that did not include criterion setting was ineffective. The focus of this study was on training instead of the actual use of the strategies during problem solving. Given this limitation, further study is needed on this topic in which both training and actual use of the strategies are evaluated.

A study conducted by Browder and colleagues (1986) examined the use of self-recording and self-evaluation on teachers' ability to interpret graphs and to make instructional decisions. Three special education teachers who work in classrooms for students with EBD participated in this study. The participants received training on graph interpretation in terms of its trend, level, and variability of students' performance in a life skill program (self-evaluation) and making instructional decisions based on instructions provided (self-recording). This intervention resulted in immediate behavior change in all three participants. However, the limitations of the study suggested the need for further replications to examine the effect of using self-recording and self-evaluation separately. While taking this note into consideration, this current study aimed to examine the effect

of self-evaluation if self-monitoring and visual performance feedback do not create a change in target behaviors.

Unlike the study conducted by Browder and colleagues (1986) where self-evaluation was incorporated into training and self-recording, Baecher, Kung, Jewkes, & Rosalia (2013) examined the use of video for self-evaluation with 31 teachers in a teacher preparation program. Teachers were divided into two conditions: (a) video and (b) text only. In the study the participants provided written reflections about their teaching performance. The researcher examined the reflections and coded responses for data analyses. The study showed that using videos can be a way to prepare teachers for their initial teaching.

The use of self-evaluation to improve teaching practices has been investigated by groups of researchers (Keller & Brady, 2005; Sutherland & Wehby, 2001). Twenty teachers from 20 classrooms from a large city in southeastern United States (Grades K-8) participated in the study conducted by Sutherland and Wehby (2001). The participants were randomly assigned into either the self-evaluation treatment group or into the no-treatment group. The target behavior to increase was the use of praise statements during instructions. Before the treatment phase the participants receiving training on the use of praise, how to videotape the teaching session, and how to calculate the rate of praise given and how to plot this result on the graph. During the treatment phase, the participants audiotaped their teaching sessions, calculated the rate of praise statements given during the session by reviewing the audiotape, and compared the rate to their own previous performances on the graph. Results from the statistical analysis showed that

self-evaluation created a short-term increase in the rate of delivering praise statements. At the same time, there was an increase in the accuracy of student responses.

Keller and Brady (2005) adapted the procedure used by Sutherland and Wehby (2001) to examine the effect of self-evaluation on the use of praise statements by student teaching interns. Instead of using statistical analysis to evaluate the impact of the intervention researchers used a single-subject research design (multiple-baseline across participants). In addition to training and the intervention phase this study included a maintenance phase to examine the long-lasting effects of the intervention. Visual analysis of the graphs indicated that all three participants immediately increased their use of praise statements when the intervention was introduced; this result replicated the findings of Sutherland and Wehby with a different research design. The generalization and maintenance probes also support the long-lasting effect of the intervention.

The above studies suggest the effectiveness of using self-evaluation to facilitate change in instructional practices and student performance. These studies used different methodologies to capture the role of self-evaluation in self-management. It is noted that self-evaluation can occur through self-talk, checklists or questionnaires, and writing with the support of video or audio. In general, further studies regarding the use of self-evaluation to improve teaching behaviors are needed (Sutherland & Wehby, 2001).

Summary

In this section, the examined studies highlight the importance of collecting data and of making data-based decisions and, at the same time, the lack of application for either among special education teachers. Technological means such as smartphones may

assist in data collection and the decision-making process. Existing studies also demonstrated the effectiveness of using self-management, performance feedback, and self-evaluation to facilitate change in instructional practices and student performance. Furthermore, reviewed studies demonstrated that CBSP and providing students with OTR during academic instructions are effective classroom management strategies. Based on existing literature the current study aimed to examine the effectiveness of an intervention package that incorporated the above elements to increase selected teachers' instructional behaviors.

The studies examined in this section used different methodologies to reflect the importance of data collection, data-based decision-making, self-monitoring during teaching, and self-evaluation on teacher behavior, particularly with respect to the use of CBSP and providing OTR to academic instructions. However, very few of these studies used a single-subject research design to capture behavior change in teachers. To address this gap the participants for the current study were teachers who worked with postsecondary students with intellectual or developmental disabilities.

The main research question for this study is, "Is there a functional relationship between the use of the KIHd system (for self-monitoring and visual performance feedback) and CBSP and GOTR to academic instructions among special education teachers who work with postsecondary students with intellectual and/or developmental disabilities?" A secondary research question for this intervention is, "During the intervention in which the KIHd system is used for self-monitoring and visual feedback, if no behavior change is observed among the participant(s), will the addition of self-

evaluation create an increase in CBSP and GOTR to academic instructions among special education teachers who work with postsecondary students with intellectual and/or developmental disabilities?”

CHAPTER THREE

This chapter presents the methodology and procedures used during this intervention study to examine the relationship between the intervention package and teachers' use of CBSP and GOTR in the postsecondary education setting for students with intellectual and developmental disabilities. This section contains information about the research design, participants, settings, materials, dependent and independent variables, and procedures for each phase of the study including data collection, interobserver agreement, treatment integrity, social validity, and data analysis.

Research Design

This study employed a single-subject, multiple-probe design across participants (teachers), which is a variation of the multiple-baseline research design to examine the effect of self-monitoring, visual performance feedback, and self-evaluation on teachers' use of CBSP and GOTR to academic instructions. In a single-subject research study researchers evaluate the functional relationship between the independent and dependent variables through systematic manipulation of the treatment (Gast, 2010). This type of research design is often used in identifying evidence-based practices in education.

The multiple-baseline design was first described by Baer et al., (1968) in the field of behavioral research. In this research design the intervention is introduced in a staggered fashion across behaviors, stimuli, or participants to demonstrate a functional relationship between the variables. The multiple-probe design was discussed by Horner

and Baer in 1978. In both multiple-baseline and multiple-probe designs the intervention is introduced when a stable baseline is reached in a tier. Once data are stable the intervention is introduced to the subsequent tiers. Internal validity threats such as history, maturation, and testing effects are evaluated in these two designs. Interobserver agreement and procedural integrity checks are required to gain confidence in the findings. Both designs can be used in applied research settings.

In the textbook written by Gast (2010) the following guidelines were provided and served as a guide for this study:

1. Identify three or more tiers of behavior, conditions, or participants that are functionally independent but functionally similar.
2. Identify a criterion level before the start of the study for staggering the introduction of the independent variable to the next tier.
3. Concurrently and repeatedly monitor changes across all tiers.
4. Introduce the independent variable to one tier when acceptable level is reached.
5. Collect data continuously during the intervention condition.
6. Introduce the independent variable to other tiers when data are stable and predetermined criterion was met.
7. Collect reliability data on the dependent variable and independent variables in each of the conditions (p. 281).

This current study followed these guidelines to demonstrate the functional relationship between the dependent and independent variables. The initial probes on

target behaviors were taken during the baseline, and periodic probe data were taken during the treatment phase across all participants. When the first participant reached a stable baseline the treatment package was introduced to that participant. When this participant reached the predetermined criterion the second participant with a stable baseline entered the intervention phase. This rule was applied to each succeeding participant in this study.

Participants and Settings

The participants for this study were recruited from a university-based postsecondary program for young adults with intellectual or developmental disabilities on the east coast of the United States. This program provides students with essential academic, life, and vocational skills for them to be successful in the community. Every semester a variety of classes taught by qualified teachers is offered to the students in the program. These teachers were the pool from which participants for this study were recruited.

To recruit the participants for this study the researcher first obtained approval from the Institutional Review Board of the university where this program resided. Appendix A is a copy of the approval letter from the Institutional Review Board. Once the approval was received the researcher sent a recruitment email to the director of the program with information about the study. The program director distributed this email electronically to the teachers who worked in this postsecondary program. Appendix B is a copy of the recruitment email that was sent to the program director. There were two selection criteria: First, all participants had to teach the same content area, writing.

Second, all participants had to teach class sessions of the same length so that the number of data points collected across participants would be consistent. Three teachers who met the two criteria and who responded to the email were selected to participate in the study. The three teachers provided their consent to participate in this study before beginning the study. In each classroom there was at least one teaching assistant available to provide additional support in the classroom. Appendix C is a copy of the consent form that the participants filled out and returned to the researcher. Table 1 shows information about the participants. *Years in teaching* reflects the amount of time that the participants had worked with young adults with disabilities at the time of the study.

Table 1.

Participant Information

Participant	Gender	Age	Years teaching
A	F	45	2
B	F	24	0
C	F	24	3

Participant A. Participant A had worked with this postsecondary program for six months before participating in this study. She was in her mid-forties and had an associate's degree. While teaching in this postsecondary program she had also been working toward a bachelor's degree in special education with adapted curriculum. Before teaching in this program she had been a preschool teacher for two years. She had

also tutored four students in writing for a year and a half. The four students whom she worked with all had ADHD and learning disabilities.

Setting A. At the beginning of the school year Participant A taught in a computer lab on the lower level of an academic building of the university where this study took place. This room had one door and was smaller than other classrooms in the building. In this room each student had a computer in front of him or her. Some students had to turn around to see the teacher at the front of the classroom. A few weeks into the school year the class was moved to a larger classroom. In this room students sat in rows and the teacher stood in front of the room for instructions. This room was equipped with LCD projectors and other technological support. This room had two doors located at each end of the room for students to enter and exit.

Participant B. Participant B was a new teacher in this postsecondary program. She was in her mid-20s at the time of the study and had a bachelor's degree in psychology. While teaching in this postsecondary program she had also been pursuing a master's degree in special education and a certificate in ABA. Before becoming a teacher at this program she had been an ABA tutor for two and a half years, providing in-home therapy for children with disabilities from 8 to 10 years old. Her responsibilities were developing behavior plans for challenging behaviors and implementing self-care programs.

Setting B. Teacher B first taught in a classroom on the second floor in the same academic building as Participant A and Participant C. This room was equipped with a TV screen and a data projector. There was one door located at the front of the room for

students to enter and exit. A few weeks into the school year this class was moved to a larger classroom located on the lower level of the same building. This room had one door in the back for students to enter and exit. The students sat in rows facing the front of the classroom where Participant B taught. This classroom and Participant A's classroom were along the same hallway separated by the computer lab in which Participant A had previously taught.

Participant C. Participant C had worked as a teacher in this postsecondary program for three semesters before participating in this study. She was in her mid-twenties at the time of the study and had a bachelor's degree in special education and a master's degree in assistive technology. Before teaching in this program she had been a practicum student who worked on remediation skills for middle school students with high incidence disabilities. She also had experience teaching reading comprehension. She had no prior experience in teaching writing classes.

Setting C. Participant C conducted her lessons in a large computer lab located on the first floor of the building. In this room students sat facing each other, each with a computer in front of him or her. To look at the teacher they had to turn their chairs to face the front of the room where the teacher stood.

Dependent Variables

There are two dependent variables in this study: (a) CBSP and (b) GOTR to academic instructions. The two dependent variables were predetermined by the researcher based on the literature review and then confirmed after the initial observation phase to ensure the practicality of these behaviors in this research setting. The

descriptions of the dependent variables are provided below, followed by a table that summarize the variables.

Contingent behavior specific praise. The first dependent variable was the use of CBSP, which is defined as a spoken statement providing positive feedback to the student and specifying the observed behavior. This type of praise differs from general praise statements because in this case the behavior for which the student is being praised is identified. In this study a few examples of contingent behavior specific praise were, "I like that you raise your hand to answer a question" and "Good job identifying the climax in this story!"

Group opportunities to respond. The second dependent variable was GOTR to academic instructions, which is defined as any spoken instructional requests made by the teacher that lead to a behavior change in students as a group in gestural, spoken, or written form. Three types of GOTR to academic instructions were:

1. Gestural (hand raising): any spoken instructional request made by the teacher that leads to all students raising hands to show agreement or disagreement.
2. Spoken (choral responding): any spoken instructional request made by the teacher that leads to all students responding orally in unison.
3. Written (use of response cards): any spoken instructional request made by the teacher that leads to all students writing answers on dry-erase boards or paper and displaying their responses to the teacher all at once.

Table 2 provides definitions for the dependent variables and Appendix D provides information on how data were collected for the dependent variables.

Table 2

Definitions for Dependent Variables

Target behavior (dependent variable)	Definition
CBSP	A spoken statement providing positive feedback to the student and specifying the observed behavior
GOTR to academic instructions (gestural)	Teacher request that provides opportunity for students to respond as a group by hand raising
GOTR to academic instructions (spoken)	Teacher request that provides opportunity for students to give a choral response or read academic material expressively in unison
GOTR to academic instructions (written)	Teacher request that provides opportunity for students to respond with a response card, that is on a dry-erase board or paper, and then display as a group to the instructor

Note. CBSP = Contingent Behavior Specific Praise; GOTR = Group Opportunities to Respond

Independent Variable

The independent variable of this study is the intervention package, which included four components: (a) training, (b) self-monitoring, (c) visual performance feedback, and (d) self-evaluation using a guided script. The intervention was carried out in this order based on the participant performance.

During the first phase of the intervention a 1-hr long performance-based training was provided to the participants individually; each participant received the same content information. The purpose of this training was for participants to learn how to use the KIHd system and the target behaviors that they were about to self-monitor.

Self-monitoring and visual performance feedback were features embedded in the KIHd system app. This app was used as a self-monitoring device to collect data on the teachers' use of CBSP and GOTR to academic instructions. After data were collected with the KIHd system the participants pressed a specific button on the app to generate graphs (visual performance feedback) for CBSP and GOTR to academic instructions.

During the self-monitoring and visual performance feedback phase, if no behavior change was observed, then a self-evaluation component was added into the intervention package. Self-evaluation was completed at the end of the sessions when the participants engaged in self-talk using a guided script relevant to the interpretation of graphs and making decisions for future lessons.

Materials

The materials used in this study were iPads that contained the KIHd system app for the participants; video cameras to record training sessions, probe sessions, and maintenance sessions throughout the study; and tripod stands for stabilizing the video cameras. In addition, the researcher provided a deck of 5 by 7 flashcards to each participant to be used for GOTR in written form.

Research Procedures

This intervention study consisted of the following phases: initial observation, baseline, training, treatment, maintenance, and exit interviews. There were two parts in the treatment phase: (a) self-monitoring with visual performance feedback and (b) self-monitoring and visual performance feedback with the addition of a self-evaluation component. The details of procedure for each phase follow.

The purpose of the initial observation was to identify target behaviors for the participants. During this 1-hr observation the researcher first introduced herself to the teacher, provided her with the informed consent form, which the participants then filled out and returned, and then set up a camera to record the teaching session. The observed teachers were not interrupted during the class period.

To assess the effectiveness of the intervention, first, the target behaviors had to occur frequently enough to be captured and reflected on the visual graphs. Based on this criterion and the existing literature the researcher identified CBSP and GOTR to academic instructions as the target behaviors for this study. Second, the target behaviors could not be what the teacher was using in the classroom at that time. With these criteria in mind, results from the initial observation confirmed CBSP and GOTR to academic instructions as the target strategies for the intervention. There two behaviors were the dependent variables in this current study.

Baseline procedures. The purpose of the baseline collection phase was to ensure, by repeated measurements, that the target behaviors did not occur without the intervention. The researcher and research assistant went into the classrooms 10 min

before the beginning of each class session to set up the cameras. During this phase teachers carried out their lessons as planned and were not interrupted during the class sessions. At the end of each baseline session the researcher watched the video recording and counted how many times CBSP and GOTR to academic instructions occurred. When a stable baseline was established for one classroom the participant entered the training phase of the study. Data collection in this phase focused on the number of times that the participants provided CBSP and GOTR to academic instructions. The count then was converted to rate to ensure data consistency across all participants.

Training procedure. After a participant reached a stable baseline (five or more data points showing a stable trend) she then entered the training phase. The training lasted for approximately an hour, depending on how well the participant acquired the information provided. The training sessions were conducted one-on-one, guided by a PowerPoint presentation in a university classroom. At the end of the training the researcher also provided the participants with a written guide as a reference for this training. The researcher conducted a total of three training sessions. These training sessions were video recorded for reliability check purposes. The participants also filled out an evaluation at the end of the training session to make sure that they received all the information that was needed for this study.

The purposes and goals for this training were to: (a) provide participants information about on how the KIHd system was developed, what it could do, and what it looked like; (b) teach participants how to self-monitor using the KIHd system when the target behaviors occur; (c) teach participants how to collect data and to transform the

data into graphs with the KIHd system app; (d) teach participants how to evaluate the data by examining the level, trend, and variability in the data; and (e) guide participants through the steps included in an intervention session. Appendix E provides a task analysis for using the KIHd system.

To ensure mastery of the KIHd system app and understanding of the procedures involved in this study the researcher used the competency-based training model, which included the following steps conducted by the researcher: (a) task analysis of the procedures for using the KIHd system to collect data and to transform data onto graphs. (b) discussion of the procedure with the participants and response to any questions from participants; (c) modeling use of the KIHd system to collect data and transformation of data into graphs; (d) observation and data collection related to how the participant used the KIHd system to collect data and produce graphs and feedback to participants; and (e) observation and data collection relevant to how the participants performed the tasks in their natural teaching environment and postsession feedback given to participants.

At the end of the training the participants completed an evaluation where they answered a few questions orally pertaining to the goals of the training. To demonstrate their readiness to move on to the intervention phase the participants also displayed the following skills in a mock session with the researcher: (a) talking about the steps included in an intervention session and performing the intervention steps, which included launching the KIHd system, self-monitoring every 10 min by recording data on the KIHd system, and obtaining visual performance feedback by generating the graphs on the KIHd system; and (b) showing how to collect data during teaching, transforming the data into

graphs, and evaluating the graphs with the information acquired during the training session. Appendix F provides a list of objectives that the participants had to meet at the end of the training session in order to proceed to the intervention phase.

After the one-on-one training the teacher practiced the steps of the study during an actual instructional period. Once the participant had mastered the skills taught in the training phase she then entered the treatment phase, which involved using the KIHd system app during instructions to self-monitor the use of CBSP and GOTR to academic instructions. Once the participant had demonstrated competency in following the intervention procedures, no additional discussion about the intervention procedures was offered.

Figure 1. Startup screen for the KIHd system

Figure 1 is a screenshot of the first image that the teachers saw on their iPad screens during the training. For this study the researcher created a program for data collection. Participants immediately pressed "Start" on this screen to proceed to the next step (see

Figure 2). On this page participants selected the program by pressing the "Click to

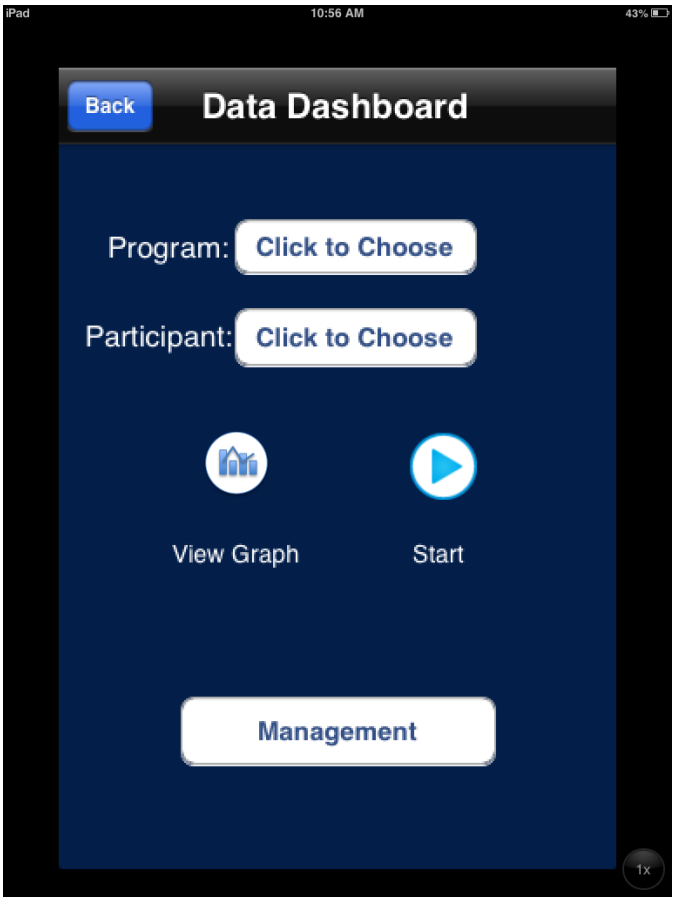

Figure 2. Data Dashboard on which program and participant are displayed after selection

Choose" button, which was preset for this study. The "Participant" button indicated the pseudonym of the individual (assigned by the researcher to ensure confidentiality) that was taking the data. This selection was also preprogrammed by the researcher. Once the program and participant were set, participants pressed "Start" to proceed to the next page (see Figure 3).

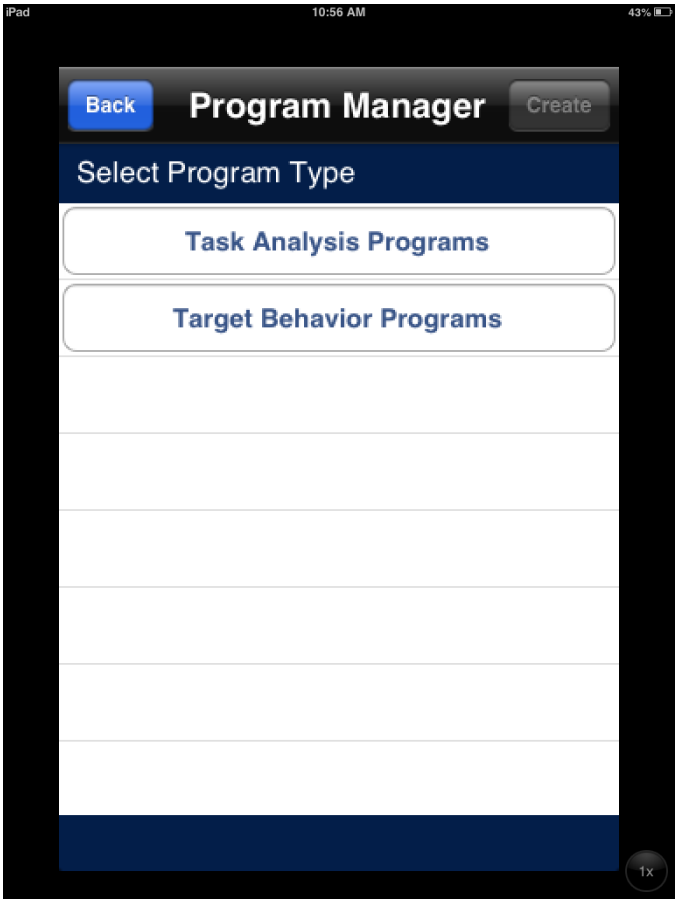

Figure 3. Screen on which type of program was selected

Figure 3 shows the page where participants selected the program. Two options were available: task analysis and target behavior programs. Task analysis was used when the target skill involved a series of steps to be completed by the individual. Examples of skills for which task analyses are appropriate are hand washing, shoe tying, and making food. The target behavior option was used when a single behavior was the behavior of interest. For the purpose of this study, participants used the target behavior program, which was shown on the next page (see Figure 4).

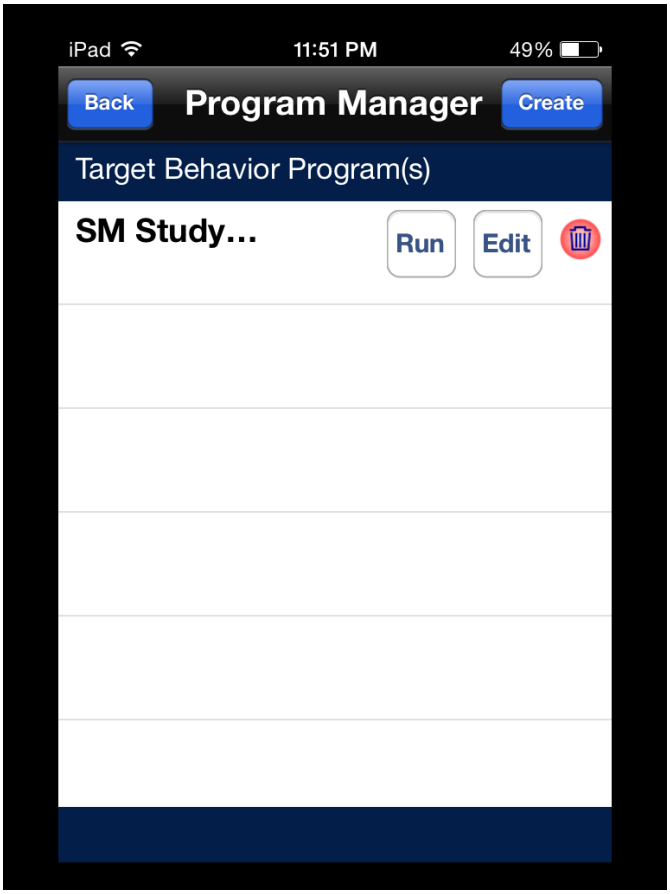

Figure 4. Screen on which the appropriate program was selected

Figure 4 shows the name of the program that participants chose for this study, SM Study, in other words Self-Monitoring Study, an abbreviated description of this study. Participants pressed the "Run" button and were taken to the next page. The other two buttons available on this page were "Back," which returned to the previous screen (Figure 3), and "Create," which was for creating new programs to collect data on other behaviors of interest. After pressing this button participants were taken back to the previous page to begin data collection (see Figure 5).

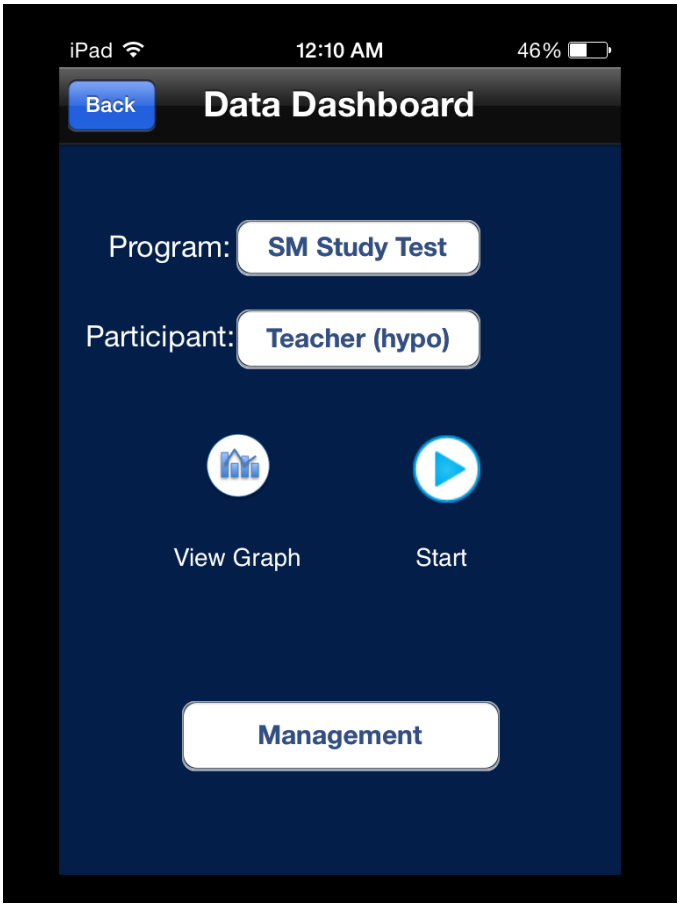

Figure 5. Data Dashboard with display of selected program and participant

Figure 5 shows the page that participants saw after selecting the program, "SM Study." This page is the same as the one displayed in Figure 2; however, participants would see at this point their selections for "Program" and "Participant." Participants could begin data collection by pressing the "Start" button, which led to the next page (see Figure 6).

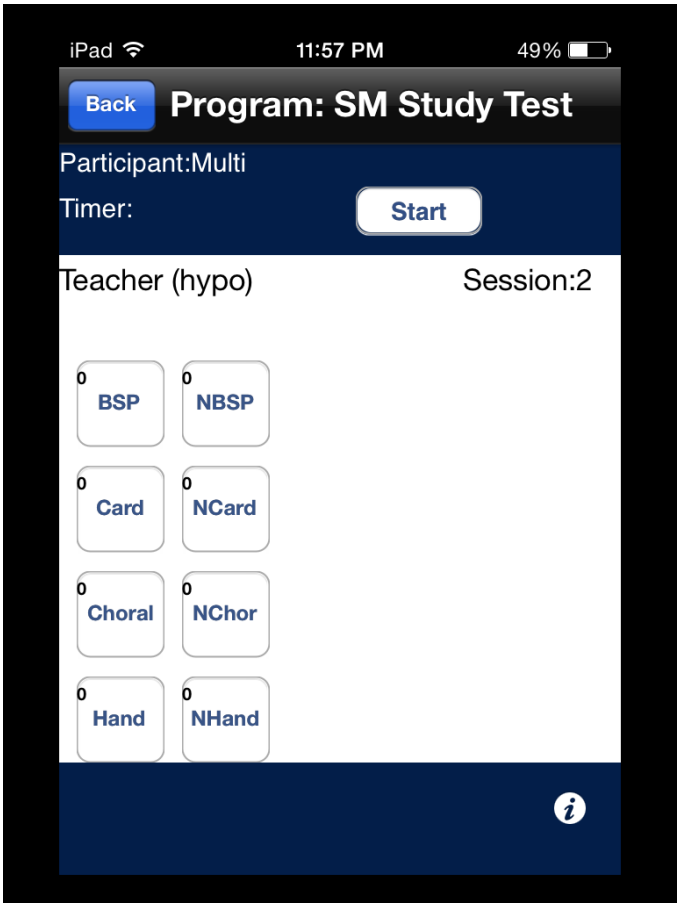

Figure 6. Data-collection screen

Figure 6 shows the page where participants took data. At the top of the screen the participants pressed the "Start" button to begin the data-collection process. The "Start" button displayed "Stop" after it had been pressed. The top row under the participant's name indicated if CBSP occurred during the interval ("BSP"), or if CBSP did not occur during the internal ("NBSP").

The second row addressed GOTR to academic instructions in the format of a response card. "Card" indicated that a response card had been used, and "NCard" indicated that a response card had not been used. The third row represented GOTR to

academic instructions in the format of choral responding. "Choral" indicated that choral responding had occurred, and "NChor" indicated that choral responding had not occurred. The fourth row indicated the use of GOTR to academic instructions by hand raising. "Hand" meant that the group had raised their hands, and "NHand" meant that the group had not raised their hands.

At the end of each 10-min interval the audio reminder, a beep, sounded. The participants then selected and pressed one of the two icons in each row to record their use of CBSP and GOTR to academic instructions during that time interval. For example, if CBSP had occurred during the previous interval, the participant pressed "BSP" in the top row. In the second row, if the participant had not provided GOTR with response cards, then she pressed the "NCard" button. In the third row, if the participant had provided GOTR with choral responding, then the participant pressed the "Choral" button. In the fourth row, if the participant had not provided GOTR by hand raising, then the participant pressed the "NHand." Four buttons were pressed for each 10-min interval. When data collection had been completed for a session (five intervals), the participant pressed the "Stop" button to return to the previous screen (see Figure 7) to generate graphs as a form of visual performance feedback.

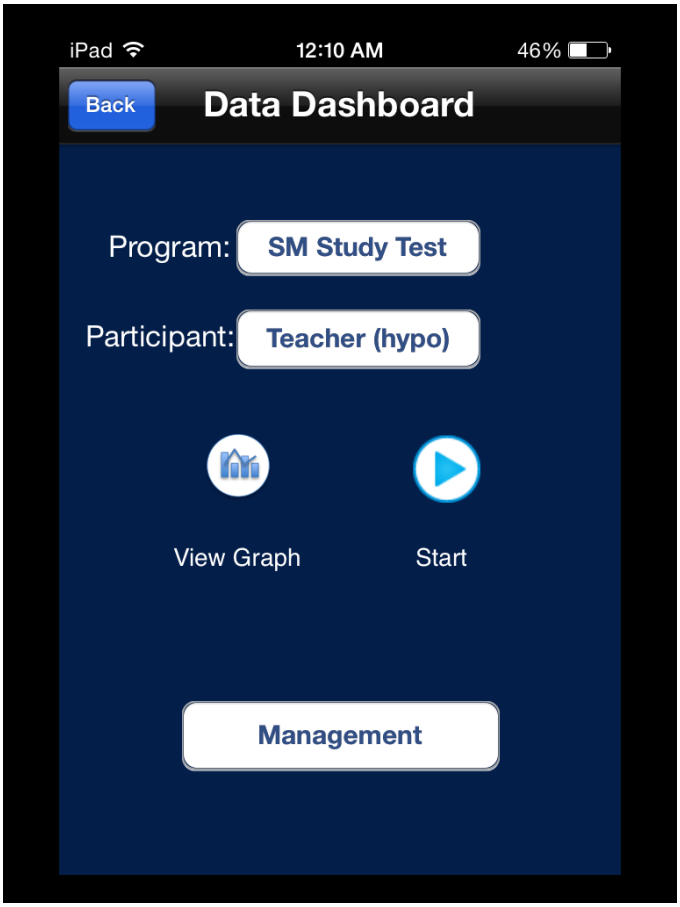

Figure 7. Data Dashboard

At this screen, participants pressed "View graph" to gain access to the graphs (see Figure 8).

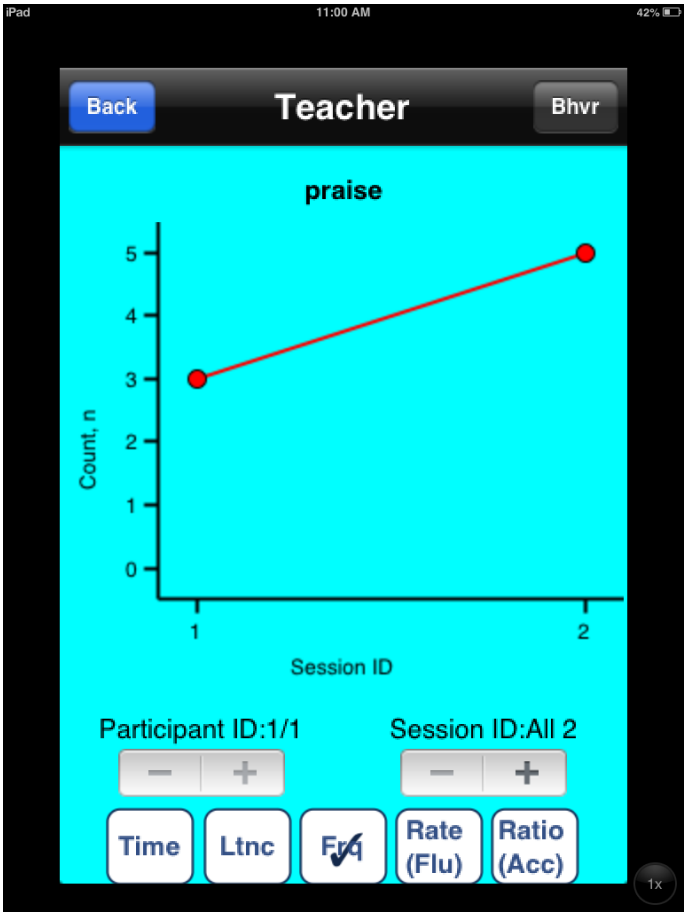

Figure 8. Graph display

Figure 8 shows an example of a graph a participant might see. This particular graph shows the occurrences of CBSP during Session 2. This graph indicates that during Session 2 CBSP occurred five times (out of five intervals during an instructional period). The display also indicates that this result was an improvement over Session 1, where CBSP only occurred three times.

Treatment procedures. The following two sections describe the procedures for two phases of the treatment package. The first phase included self-monitoring and visual performance feedback. The second phase was the addition of self-evaluation. All

participants underwent the self-monitoring and visual performance feedback phase. If the participants did not display behavior change then the self-evaluation component was added into the treatment package.

Self-monitoring and visual performance feedback. During each intervention phase session the participants stood by or held an iPad (provided by the researcher), which contained the KIHd app to self-monitor their behaviors. The data-collection program used during the intervention phase was programmed during the training phase so no further training or modifications were needed. The KIHd system app contained a timer feature for collecting data. A class period was broken down into intervals of 10 min, which was the time interval during which the participants would self-monitor their use of target strategies. There were five time intervals in an instructional period, which meant that the participants recorded data on their behaviors five times.

The researcher and the research assistant set up cameras in the classrooms 10 min before the beginning of each instructional period. The participant used a verbal cue to indicate that a session had begun. A few examples of the verbal cues used were, "Let's get started" or "Alright, good morning everyone." At this time the teacher pressed the "Start" button in the KIHd app to begin the intervention session.

During instructions, the teacher placed the iPad on a nearby table or held the iPad to receive reminders about when to self-monitor her behaviors (collect data on CBSP and GOTR to academic instructions) that had occurred during the previous time interval. When the timer went off the participant went to the iPad (or held up the iPad) and pressed the appropriate buttons, such as "BSP" (CBSP did occur during the interval) or "NBSP"

(CBSP did not occur during the interval). This data collection was repeated every 10 min for the duration of a class period, for a total of five data entries.

Immediately after class the participants generated four graphs that showed their use of the target strategies during the lesson. The four graphs were for CBSP, GOTR to academic instructions in gestural form, GOTR to academic instructions in spoken form, and GOTR to academic instructions in written form. Every session was conducted exactly the same way across all participants. Appendix E describes the steps for using the KIHd system; this list was also used for a treatment integrity check.

Self-monitoring, visual performance feedback, and self-evaluation. Another component of this intervention phase was self-evaluation, which for the purposes of this study is defined as describing and making decisions out loud about the use of target behavior by using a list of guided questions. It is assumed that when teachers examined their graphs they were engaging in self-evaluation as a private event. This portion of the intervention transformed this private event into an observable event and was used when self-monitoring and visual performance feedback produced little change in behaviors.

Before the implementation of this phase the participants received a 30-min performance-based training on how to use the guided questions to self-evaluate their performance in using CBSP and providing GOTR to academic instructions. After this training session, the participants conducted sessions as they typically would using the KIHd system to self-monitor their behaviors. At the end of the session the participant generated the four graphs and conducted a self-evaluation out loud in front of the camera. Appendix G provides a list of the guided questions used during this intervention phase.

In both treatment phases data collection focused on the number of times that teachers provided CBSP and GOTR to academic instructions. Every time the target behavior occurred the researcher made a tally on the data sheet. The frequency of each target behavior was converted to a rate to ensure consistency between the sessions. Appendix H presents a data collection form that was used in this study.

Maintenance procedures. Two weeks after the intervention phase was completed for all participants, maintenance data were collected to check for the sustainability of the intervention effect. The procedure for this phase was exactly the same as for the baseline phases. The participants conducted a teaching session as they normally would without interruptions from the researcher and without the use of the KIHd system app as a self-monitoring and visual performance feedback tool. The maintenance phase session was also video recorded for data collection and reliability check purposes.

Data collection during this phase also focused on the number of times that the participants provided CBSP and GOTR to academic instructions. Each instance of the target behavior was recorded and then converted to a rate. Appendix I presents a data collection form that was used during the maintenance phase of this study.

Reliability and Validity

The purpose of conducting reliability and validity checks is to ensure the study is conducted in a consistently high-quality manner and to support this level of quality for the duration of the study (Gast, 2010). There are three areas for reliability in single-subject research designs related to consistency: reliability of effect, reliability of

measurement, and procedural reliability (or procedural integrity). Reliability of effect refers to the researcher's level of confidence that the same results would be obtained if the experiment were repeated. This check is addressed by using an established research design, the multiple probe design, to introduce the intervention in a staggered fashion across the participants. Reliability of measures covers the accuracy and consistency of the data; this check is addressed in the section below about interobserver agreement. Procedural reliability is concerned with the degree to which the intervention was implemented according to the researcher's original, stated plan. This level of reliability is addressed by calculating the number of steps that the procedures were carried out correctly by the participants.

Validity concerns, both internal and external, in all research relate to accuracy. Internal validity refers to the confidence that the results of the study are caused by the intervention and not other confounding variables. External validity refers to the generality and effectiveness of the independent variable (the intervention). Another type of external validity is social validity, which refers to the social significance of the study in terms of its goal, procedures, and effectiveness. In this section, information about reliability and validity procedures and scoring is presented to demonstrate how reliability and validity are considered, addressed, and protected in this study.

Interobserver agreement. Interobserver agreement (IOA) requires that two data collectors conduct independent observations of the target behaviors using the same data-collection method. The researcher conducted the main data collection by tallying the occurrences (frequencies) of the target behaviors as they occurred during the baseline and

treatment sessions. The frequencies were then converted into a rate. A video recording was also made of each session. The research assistant used these video recordings to conduct the reliability checks.

Before conducting the reliability check independently, the researcher defined all key terms for the research assistant and then ran a practice data-taking session. First, the research assistant reviewed a list of definitions for each dependent variable. The researcher then answered any questions that the research assistant had regarding the definitions. Then the researcher and the research assistant reviewed a video clip and scored the video together. When an inconsistency arose between the researcher's and the research assistant's scoring, the two immediately reviewed the behavior again from the video and determined the cause of the error. When agreement had been reached for the clip, the research assistant scored a video clip independently. The scores recorded by the research assistant were compared with those of the researcher.

More than 36% of the baseline sessions and treatment sessions as well as the sole maintenance session (thus 100%) were evaluated for reliability. Reliabilities for all sessions were calculated by dividing the rate with a lower number by the rate with a higher number and then multiplying by 100%. The results of the reliability check are presented in the next chapter in which results from this study are discussed.

The researcher was responsible for setting up and taking down equipment after before and after every session, conducting training for the participants as a part of the intervention package, collecting relevant data throughout all phases of the study, training the research assistant on how to conduct the interobserver agreement check, conducting

procedural integrity check, and conducting social validity interviews with the participants.

Procedural Integrity

Procedural integrity describes to what extent the intervention went as planned; this measure establishes the interval validity of the study. High procedural integrity suggests that behavior changes are caused by the intervention. This section describes the procedures and scores for the procedure reliability in this study. In this study two procedural integrity checks were conducted: one for the training sessions and one for the treatment sessions.

Procedural integrity for training sessions. During the training sessions procedural integrity was conducted to examine the accuracy of information provided to the participants. During the training, the researcher followed a checklist of items to deliver to the participants. At the end of the training sessions the teachers each filled out an identical checklist to ensure that every item on the checklist had been given to them. The training sessions were also video recorded to ensure that all information was provided to the participants accurately and consistently.

Procedural integrity during treatment phase. During the intervention phase the participants were the implementers carrying out the procedures. Therefore, procedural integrity data were taken by the researcher to examine how well the participants followed the implementation plan. A checklist that included the steps of the intervention was used to examine the procedural integrity during each probe session. Appendix J shows the list of steps involved in procedural integrity check. The procedural integrity was calculated

as a percentage, which was calculated by dividing the number of steps completed correctly by the number of steps listed in the procedural integrity checklist and then multiplying by 100%. The treatment integrity for all training sessions was 100%.

Another level of the treatment integrity focused on the accuracy of self-monitoring, which refers to how accurately the participants recorded the occurrences of target behaviors. Three calculations were made for this level of treatment integrity: the percentage of interobserver agreement for occurrences, the percentage of interobserver agreement for nonoccurrences, and the percentage of overall interobserver agreement. The percentage of interobserver agreement for occurrences was calculated as follows:

$$\frac{\text{occurrence agreement}}{\text{occurrence agreement} + \text{occurrence disagreement}} \times 100\%$$

The percentage of interobserver agreement for nonoccurrences was calculated as follows:

$$\frac{\text{nonoccurrence agreement}}{\text{nonoccurrence agreement} + \text{nonoccurrence disagreement}} \times 100\%$$

The percentage of overall interobserver agreement was calculated as follows:

$$\frac{\text{number of agreements}}{\text{number of agreements} + \text{number of disagreements}} \times 100\%$$

.

During the treatment phase 33% of the sessions were examined for procedural integrity with a resultant score ranging from 80% to 100% for all three types of

calculations. This seemingly low percentage was the result of working with small numbers. Because there were only five intervals in each treatment session, one disagreement would cause the percentage to drop from 100% to 80%; a result of 80%, then, indicates that there was only one instance of disagreement between the participant recording and the researcher observation.

Social Validity

Social validity provides information about how useful and appropriate the intervention was for the participants. Upon completion of the study, the researcher conducted a semi-structured interview with each participant individually to examine the social validity of the study and to receive feedback about the intervention. Appendix K provides the list of interview questions. Each interview lasted approximately 45 min and was audio recorded for further analysis, including an examination of similarities and differences across the responses. Responses from the interviews were summarized and are reported in the next chapter. Demographic information, such as the teacher's age, educational background, years in teaching, and other teaching experience was also collected at the end of the interview. Appendix L is a copy of the demographic interview questionnaire.

Data Analysis

The two dependent variables of this intervention study were the use of CBSP and providing GOTR to academic instructions. These two dependent variables were measured by using the direct data recording method to capture how many times the target behavior occurred during each session. After each session the researcher immediately

reviewed the video and scored the teacher's behaviors on the data-collection sheet. Then the researcher plotted the data on separate graphs for all participants based on the phase of the experiment they were in. The researcher also wrote anecdotal notes about events that occurred during the session such as class activities, administrator observations, and teacher absences.

Visual analysis. In a single-subject research design, data are analyzed through visual analysis (Gast, 2010). To examine the data the researcher graphed each data point from a session using Microsoft Excel. Data points for two dependent variables for each participant were used to construct two graphs. The data points were connected within each phase of the study. To respond to the research questions the researcher looked for patterns in these elements of the data lines: level, trend, variability, immediacy of the effect, overlap, and consistency of the data. These elements were evaluated on an individual level and across the participants to examine the functional relationship between the dependent and independent variables (Kratochwill et al., 2010), representing the strength of this type of research design.

In this study the researcher examined the data pattern in terms of level, trend, variability, immediacy of effect, overlap, and consistency among data. Level refers to the mean score for the data within a phase. Trend is the slope of the best-fitting straight line for the data within a phase (Kennedy, 2005). It is described by the direction that the data take on the graph. Variability is how much the data change given the standard deviation of the data. These three elements revealed the quantity and degree of change the dependent variables underwent as a result of the independent variable.

The researcher also examined the immediacy of the effect, overlap, and consistency of the data across phases. At this level of analysis the extent of the functional relationship that existed between the independent variable and the dependent variables was also further examined. Examining the immediacy of data change involved looking at the last three data points of the baseline phase (level) and the first three data points (level) of the treatment phase. Consistency of the data refers to how the data from all the same phases across the participants compared to each other. The percentage of nonoverlapping data (PND) was used to examine the overlap of the data. This calculation was conducted to quantify the change in data between the baseline phase and the intervention phase (Scruggs & Mastropieri, 2012).

The PND was calculated by determining the range of the data points, counting the data points in the intervention phase, and then determining the number of intervention data points that did not extend the range of the baseline data points. The number of data points that did not extend the range of the baseline data points was divided by the number of total data points and then multiplied by 100%. This calculation resulted in a PND, which described the overlap between the data points.

Summary

This chapter provides detailed information regarding how this study was conducted, including: (a) research design, participants and settings, and reliability and validity; (b) operational definition and discussion of the independent variable and dependent variables; (c) procedures used for each phase of the study; and (d) discussion of components of data analysis. This last topic, the components of data analysis, serves as

a preparation for the next chapter in which results are presented. Tables 3 and 4 provide information about how each research question was addressed with data analysis procedures, where were describe in chapter 1.

Table 3

Description of Research Question 1

Is there a functional relationship between the use of the KIHd system and the use of CBSP and GOTR?		
Subquestions	Source of data for response	Type of data analysis
1. Functional relationship between the KIHd system and contingent behavior specific praise	Frequency and rate of CBSP	Visual analysis
2. Functional relationship the KIHd system and group opportunities to respond to academic instructions?	Frequency and rate of GOTR	Same as above

Note. CBSP = Contingent Behavior Specific Praise; GOTR = Group Opportunities to Respond

Table 4

Description of Research Question 2

Will the addition of self-evaluation impact CBSP and GOTR if using the KIHd system along does not?		
Subquestions	Source of data	Type of data analysis
1. Does the use of self-evaluation affect CBSP?	Frequency and rate of CBSP	Visual analysis:
2. Does the use of self-evaluation affect GOTR?	Frequency and rate of GOTR	Same as above

CHAPTER FOUR

This chapter presents the results of this multiple-probe, single-subject research study that examined the use of self-monitoring, visual performance feedback embedded in a data-collection system app, the KIHd system, and self-evaluation of teachers' decision-making regarding their use of evidence-based strategies (CBSP and GOTR to academic instructions) in the classrooms for young adults with intellectual and developmental disabilities in a postsecondary program.

As described in the previous chapter the participants for this study were three teachers who taught in a postsecondary program for young adults with intellectual or developmental disabilities. The study was designed to examine how an intervention that included self-monitoring, visual performance feedback, and self-evaluation impacted the two dependent variables in this study. The two dependent variables were the teachers' use of CBSP and providing GOTR to academic instructions. The guidelines of a single-subject, multiple probe design were followed to design this experiment, which included baseline, intervention, and maintenance phases for all three participants; the intervention was introduced in a staggered fashion to demonstrate the functional relationship between the variables.

During this experiment the participants used the KIHd system app to self-monitor their behavior, and they generated graphs for visual performance feedback. Two of the

participants also underwent the self-evaluation phase. Each class session was broken down into five intervals of 10 min each. When the embedded timer went off in the KIHd system, the participants collected data on their behaviors using the KIHd system. At the end of the class session the participants generated the graphs corresponding to the target behavior for visual performance feedback. In the self-evaluation phase the participants further discussed the graphs as a part of the decision-making process for future teaching. At the end of each session the researcher reviewed the video recording of the session and tallied the number of occurrences for each target behavior. The frequency was then converted into rate to enable comparison between participants and with existing research.

There were two main research questions for this study, and for each research question there were two subquestions. The first research question examined the functional relationship between self-monitoring and visual performance feedback, embedded in the KIHd system app, as well as the teachers' use of CBSP and GOTR to academic instructions. The second research question examined the functional relationship between self-monitoring, visual performance feedback embedded in the KIHd system, and self-evaluation and CBSP and GOTR to academic instructions. The analysis of the graphs is presented below.

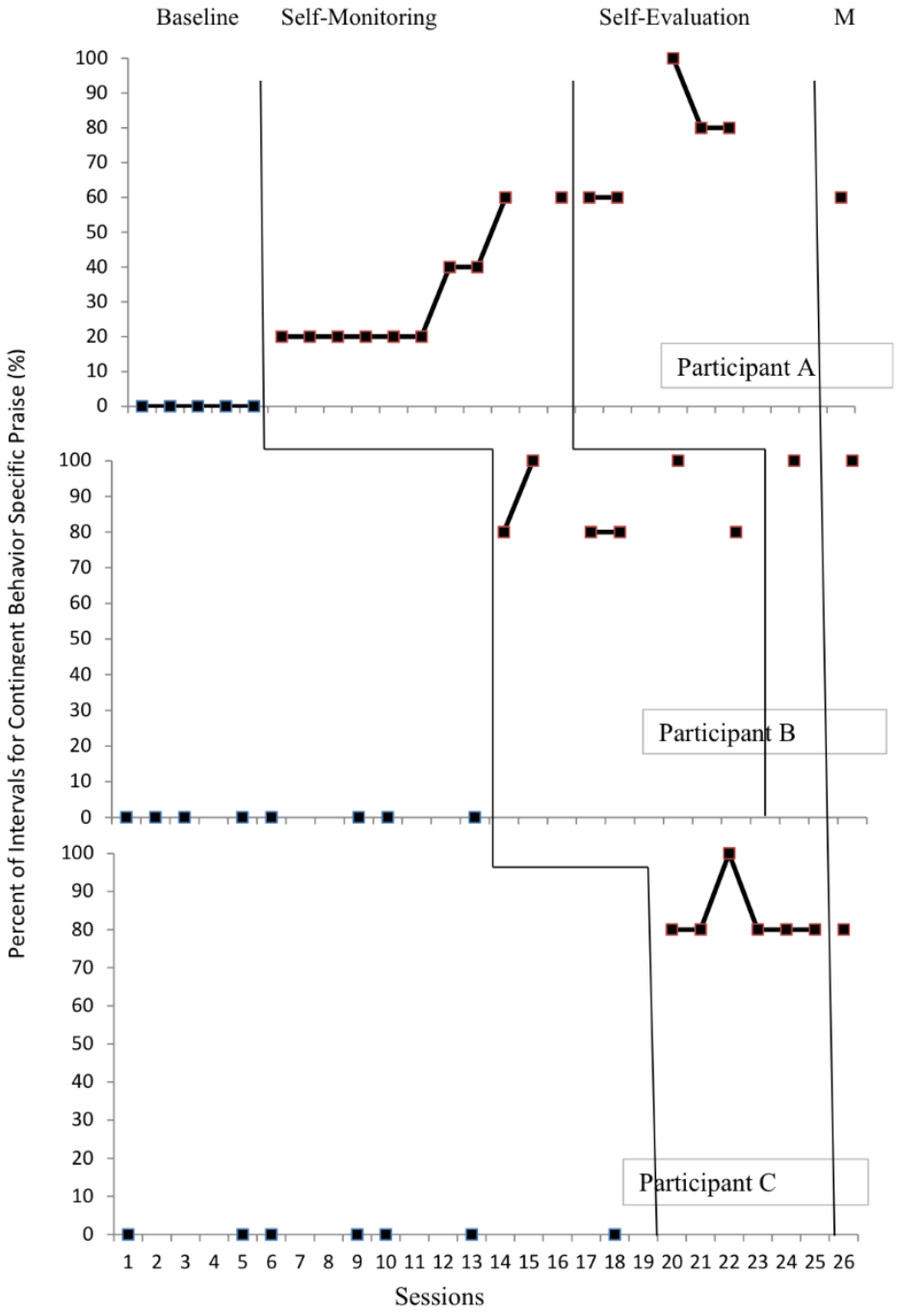

Figure 9. Participants' recordings for CBSP based on interval data collection across the Baseline Phase, Intervention Phase 1 (self-monitoring and visual performance feedback), Intervention Phase 2 (self-evaluation), and the Maintenance Phase (M).

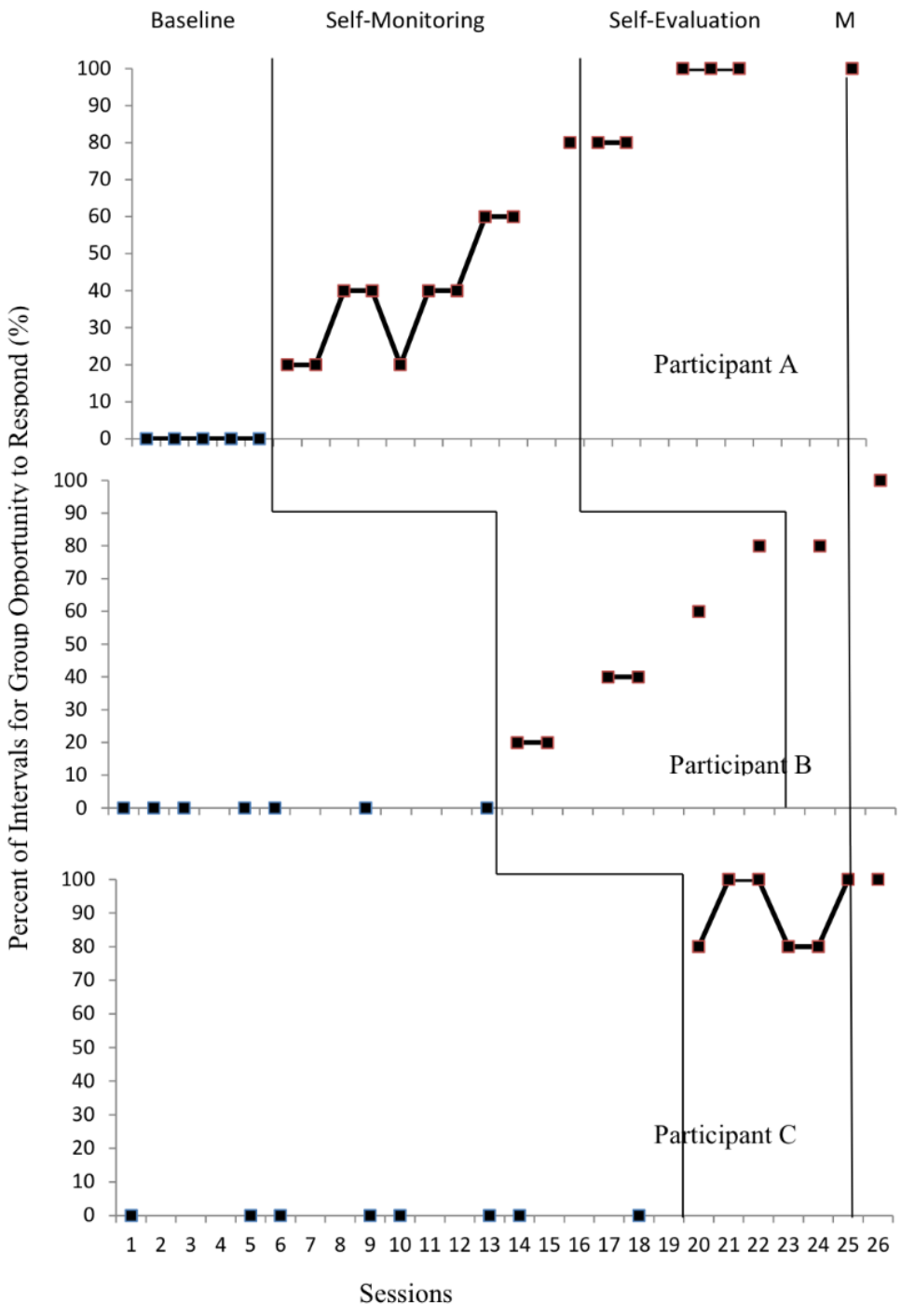

Figure 10. Participants' recordings for GOTR to academic instructions based on interval data collection across Baseline phase, Intervention phase 1 (self-monitoring and visual performance feedback), Intervention phase 2 (self-evaluation), and Maintenance phase (M).

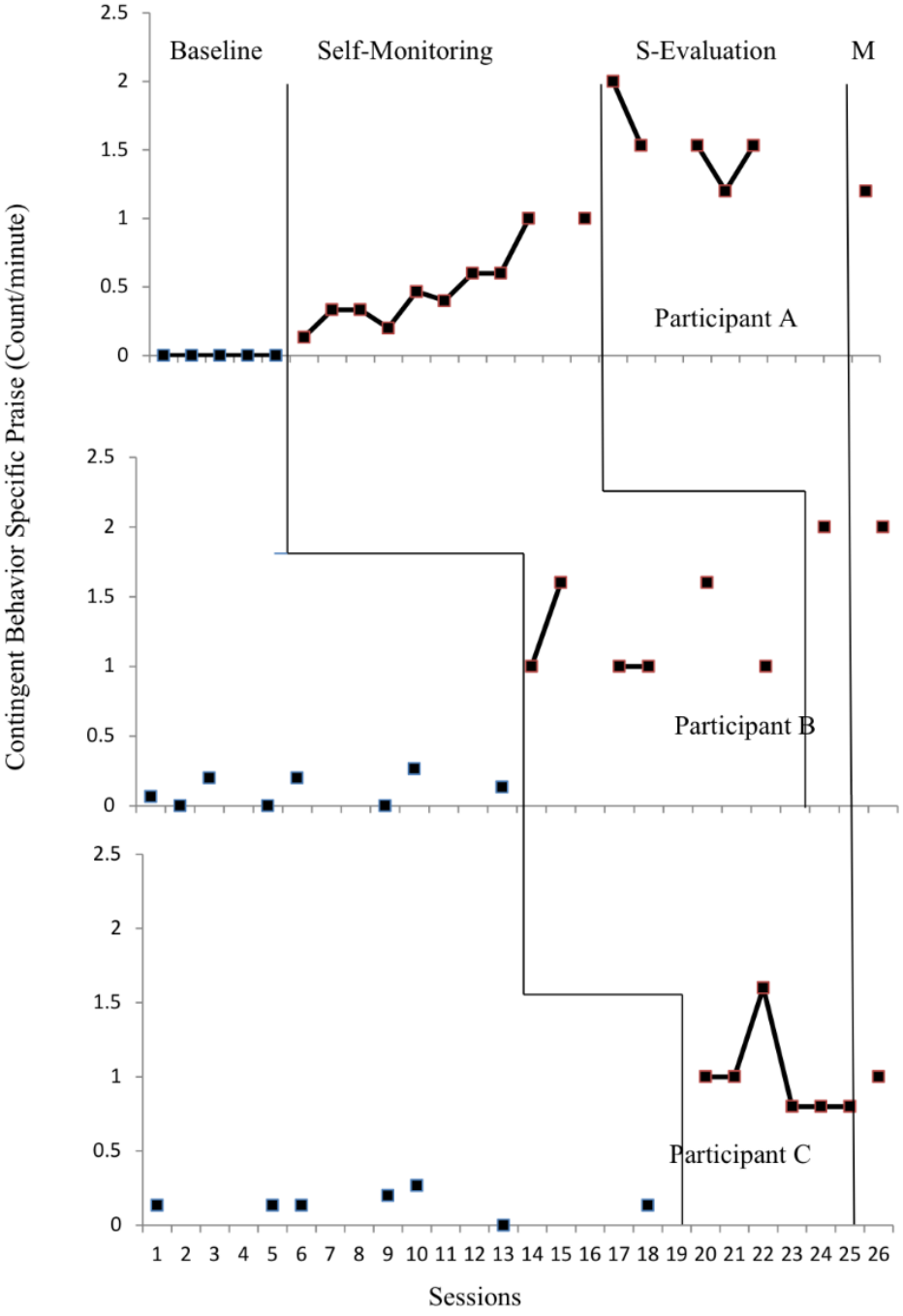

Figure 11. The rate of CBSP praise used by all participants across the Baseline phase, Self-monitoring and visual performance feedback phase (Self-monitoring), S-evaluation phase (Self-evaluation), and M (Maintenance phase).

Table 5

Means and Standard Deviations for Use of CBSP

Participant	Baseline		Intervention Phase 1		Intervention Phase 2		Maintenance	
	M	*SD*	*M*	*SD*	*M*	*SD*	*Rate*	*SD*
A	0	0	.51	.30	1.57	.33	1.2	NA
B	.13	.10	1.24	.29	2	NA	2	NA
C	.11	.06	1.00	.31	NA	NA	1	NA

Note. NA = not applicable; Intervention Phase 1 (Self-monitoring and visual performance feedback); Intervention Phase 2 (self-monitoring, visual performance feedback, and self-evaluation)

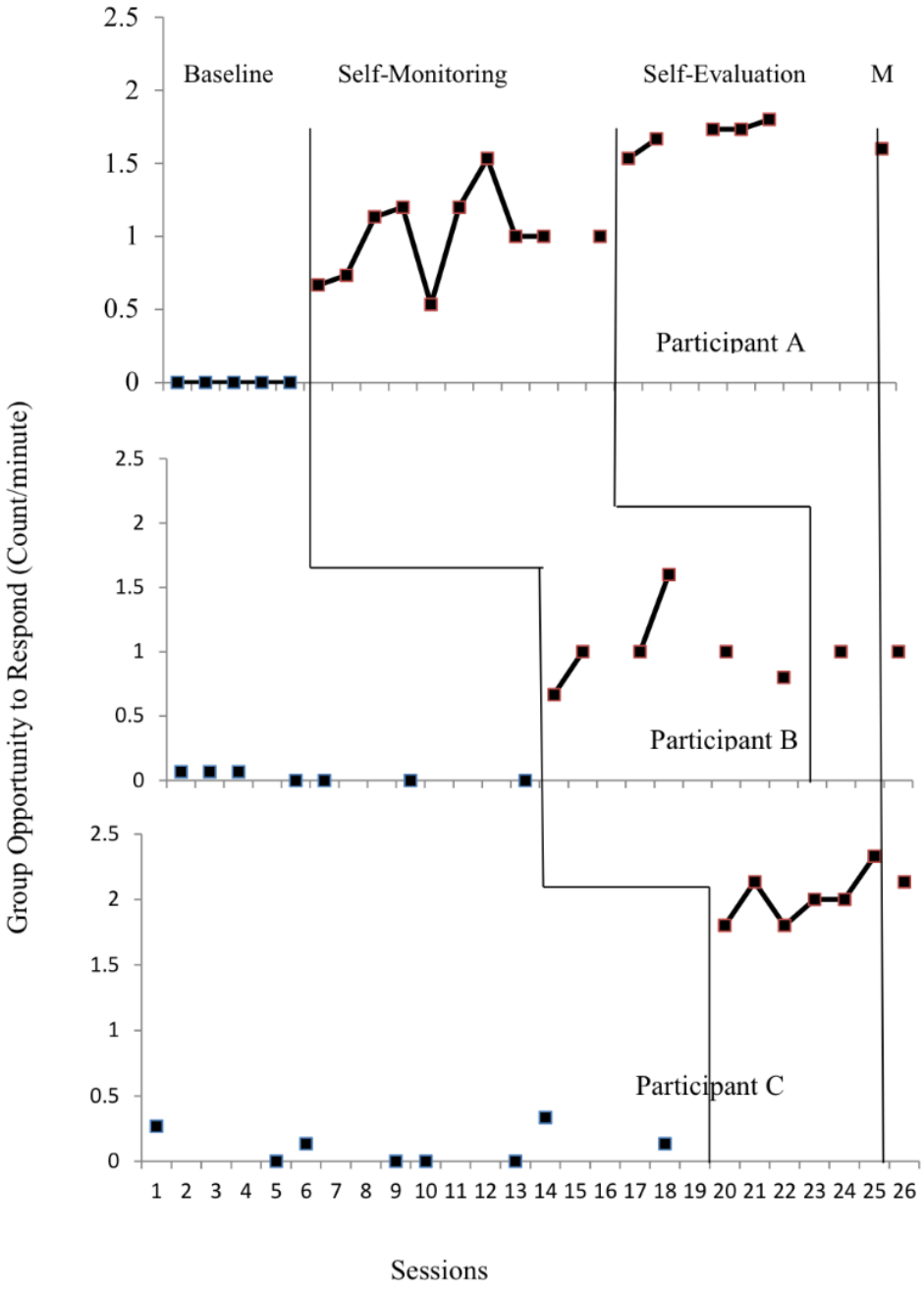

Figure 12. The rate of GOTR to academic instructions delivered by all participants across the Baseline phase, Self-monitoring and visual performance feedback phase (Self-monitoring), S-evaluation phase (Self-evaluation), and M (Maintenance phase).

Table 6

Means and Standard Deviations for GOTR to Academic Instructions Across Participants

Participant	Baseline		Treatment 1		Treatment 2		Maintenance	
	M	*SD*	*M*	*SD*	*M*	*SD*	*Rate*	*SD*
A	0	0	.99	.30	1.69	.10	1.6	NA
B	.03	.04	1.02	.35	1	NA	1	NA
C	.11	.13	2.01	.20	NA	NA	2.13	NA

Note. NA = not applicable; Intervention Phase 1 (Self-monitoring and visual performance feedback); Intervention Phase 2 (self-monitoring, visual performance feedback, and self-evaluation)

Table 5 and Table 6 show the means and standard deviation for the two target behaviors, CBSP and GOTR for all three participants. Figure 9 and Figure 10 are the final graphs for participants' recordings on the occurrence of CBSP and GOTR to academic instructions. That is, the number of intervals where CBSP and GOTR to academic instructions occurred (there were five intervals in a 50-min session) during each session. Figure 11 and Figure 12 are the final graphs on the rate of these two dependent variables calculated by the researcher. These four figures all include the baseline phase, intervention phases (two parts), and maintenance phase for all participants. Intervention Phase 1 included self-monitoring and visual performance feedback. During Intervention Phase 2, self-evaluation was added onto the components included in Intervention Phase 1. In this study Participants A and B went through both intervention phases. Participant C completed only Intervention Phase 1 because of a dramatic improvement in the target

behavior during this phase. Overall, similar patterns were observed between the participants' recordings and the researcher's recordings on the two target behaviors.

Participant A

Contingent behavior specific praise. Tier 1 (top tier) of Figure 9 and Figure 11 shows how often Participant A used CBSP before the intervention (baseline), during the intervention (Phases 1 and 2), and postintervention (maintenance). The patterns shown in Figure 9 (participants' recordings for target behaviors) and Figure 11 (researcher's recording on target behaviors) are clearly similar for this participant across all phases of the study. During the baseline phase, Participant A did not deliver CBSP. The researcher introduced the intervention package when the baseline zero level had been established over five sessions (five data points at zero). As shown in Figure 9 and 11, the introduction of the intervention (self-monitoring and visual performance feedback) led to a slight change in behavior for one out of five intervals (Figure 9) or 0 instances per minute to 0.10 instances per minute (Figure 11). Over the course of the next few sessions the graphs show a change in level and a gradual upward trend with moderate variability, with the highest performance at 2 instances per minute (M = 0.51, SD = 0.30).

Self-evaluation was introduced into the intervention to examine its effect on CBSP after 1 instance per minute was achieved in two sessions in Phase 1 of the intervention. This portion of the intervention led to an immediate increase in rate of CBSP delivery to 2 instances per minute. During the next session there was a decrease in the rate that stabilized at about 1.57 instances per minute with small variability (M = 1.57, SD = 0.33). Because the school term was ending, maintenance data were collected for

only one session. During this session Participant A provided CBSP at a rate of 1.2 instances per minute, which was a decrease from the previous intervention phase.

Group opportunities to respond. Tier 1 (top tier) of Figures 10 and 12 shows how frequently Participant A provided GOTR to academic instructions during baseline, intervention, and postintervention (maintenance). Similar to the graphs for CBSP, the patterns for the participant's and the researcher's recordings for GOTR to academic instructions were similar across all phases of the study. During baseline, Participant A did not provide students with gestural, spoken, or written GOTR. After a stable baseline had been achieved at zero, the researcher introduced the intervention that included training, self-monitoring, and visual performance feedback. As shown in Figure 12, the introduction of the intervention led to an immediate change in behavior from 0 instances per minute to 0.67 instances per minute (M = 0.72, SD = 0.57). This change was more abrupt than the change in CBSP.

The data path for Intervention Phase 1 shows a relatively stable trend except for one drop in the data point at Session 18, which was reflected in the standard deviation. During this session Participant A was observed by an administrator in the program. When Participant A had delivered GOTR to academic instructions at the rate of 1 instance per minute for two consecutive sessions self-evaluation was introduced and led to an immediate change in behavior to an average rate of 1.6 instances per minute (M = 1.60, SD = 0.28). Because of time constraints, maintenance data were taken for only one session. During this session, Participant A delivered GOTR to academic instruction at

the rate of 1.2 instances per minutes. This rate was lower than the average rate from the previous intervention phase.

Participant B

Contingent behavior specific praise. Tier 2 (middle tier) of Figure 9 and Figure 11 shows how frequently Participant B delivered CBSP before the intervention (baseline), during the intervention, and postintervention (maintenance). During the baseline phase Participant B delivered CBSP at a rate of 0.13 instances per minute (M = 0.13, SD = 0.10). When a stable baseline was reached the researcher introduced the intervention package, which led to an immediate increase in CBSP (level) to 1 instance per minute. Tier 2 of Figure 9 shows that the introduction of the intervention led Participant B to use CBSP during four of the five intervals. Due to a participant absence, a class party, and an unexpected event with the iPad, data were not collected during those sessions.

Overall, both Figure 9 and Figure 11 show that Participant B continued to deliver CBSP during the intervention phase. However, data points from these two figures do not reveal a clear pattern in behavior change. Overall, Participant B delivered CBSP at rates of between 1 instance per minute and 1.6 instances per minute (M = 1.24, SD = 0.29). The addition of the self-evaluation component led to an increase in rate to 2 instances per minute (M = 2, SD = NA). Because of time constraints, maintenance data were taken for only one session. During this session the rate of delivering CBSP was maintained at 2 instances per minute.

Group opportunities to respond. Tier 2 (middle tier) of Figure 10 and Figure 12 shows how frequently Participant B provided GOTR to academic instructions. The graphs are divided into baseline, intervention, and postintervention (maintenance). Figure 12 shows that Participant B provided a few GOTR to academic instructions during the first three sessions (M = 0.03, SD = 0.04) in the baseline phase. When the intervention was introduced there was an immediate increase in rate to 0.67 instances per minute. The variability in behavior change appears similar to the change seen in CBSP. However, as shown in Figure 10, Participant B continued to improve on providing GOTR to academic instructions throughout the session. The highest rate for providing GOTR to academic instructions was 1.6 instances per minute (M = 1.02, SD = 0.35), followed by a decrease in rate during the next two probe sessions.

Because of a participant absence, a student party, and an unforeseen event with the iPad there were three sessions in which data were not collected. Therefore, data points between those sessions were not collected. After self-evaluation was added into the intervention package Participant B only conducted one more session in which academic instructions occurred. During that session her rate of GOTR to academic instructions was 1 instance per minute (M = 1, SD = 0), which was similar to the previous intervention phase involving self-monitoring and visual performance feedback. During the maintenance session this rate remained the same for Participant B (M = 1, SD = 0).

Participant C

Contingent behavior specific praise. Tier 3 (bottom tier) of Figures 9 and 11 shows how frequently Participant C delivered CBSP before the intervention (baseline),

during the intervention, and postintervention (maintenance). Similar patterns were observed in both the participant's and the researcher's recording of CBSP. During the baseline, Participant C delivered some CBSP at an average rate of 0.11 times per minute (M = 0.11, SD = 0.06). When the intervention package was introduced there was an immediate increase in the rate of delivering CBSP to 1 instance per minute. The participant's recording indicates that she delivered CBSP during four out of the five intervals in a session. Data collection over the next few sessions showed a stable trend with an exceptional data point at the rate of 1.6 instances per minute. For the next three data points the rate of CBSP delivery stabilized at 0.8 instances per minute (M = 0.10, SD = 0.31). Because of an abrupt behavior change Participant C did not participate in the self-evaluation phase. During the maintenance session the rate of delivering CBSP was 1 instance per minute.

Group opportunities to respond. Tier 3 (bottom tier) of Figure 10 and Figure 12 shows how frequently Participant C provided GOTR to academic instructions. The graph is divided into baseline, intervention, and postintervention (maintenance) phases. Both Figure 10 and Figure 12 show that the introduction of the intervention led to an immediate increase in providing GOTR to academic instructions. The participant's recording indicates that she delivered GOTR to academic instructions during four out of the five intervals during the session.

In terms of rate of providing GOTR to academic instructions, Figure 12 shows that during the baseline phase Participant C provided GOTR to academic instructions in gestural form and spoken form (M = 0.11, SD = 0.13). Implementation of the

intervention led to an immediate behavior change to 1.8 instances per minute. She maintained this level of behavior change during the next few sessions with stable trend and relatively small variability (M = 2.01, SD = 0.20). During the maintenance session Participant C delivered GOTR to academic instructions at the rate of 2.13 instances per minute.

Across Participants

In response to the first research question, data from all three participants showed an immediate change (level) in their behaviors (CBSP and GOTR to academic instructions) when the KIHd system was used. This pattern is visible in both the participants' recordings (Figure 9 and Figure 10) and in the researcher's recording on CBSP and GOTR to academic instructions (Figure 11 and Figure 12). The behavior change in delivering CBSP was more abrupt for Participants B and C than for Participant A. Regarding GOTR to academic instructions, Participant C changed the most abruptly compared with Participants A and B. For Participants A and B this target behavior was developed over time as indicated by the steady and gradual trend lines in all figures.

The staggered introduction of the intervention in this multiple-probe across participants design showed prediction (comparing the baseline and intervention phases for one participant), verification (comparing the intervention phase of one participant with the baseline phase of the participant data in the tier below), and replication (comparing the baseline and intervention phases in that tier) between the intervention and the target behaviors, which is evidence for the functional relationship between the use of

the KIHd system and the delivery of CBSP and GOTR to academic instructions for all participants.

With respect to the second research question, only Participants A and B went through the self-evaluation. (Participant C did not participate in this part of the study because of an abrupt behavior change during Phase 1 of the intervention. Overall, the addition of self-evaluation led to an increase in both target behaviors for Participant A. However, because of the limited number of data points collected for Participant B, the effectiveness of this intervention phase was overall, inconclusive. All three participants continued to use CBSP and provide GOTR to academic instructions during the maintenance session.

Percentage of Nonoverlapping Data

The PND was calculated by determining the range of the data points, counting the data points in the intervention phase, and then determining the number of intervention data points that did not extend beyond the range of the baseline data points. The number of data points that did not extend the range of the baseline data points was divided by the number of total data points and then multiplied by 100%.

For all three participants there was a clear differentiation between the baseline phase and the intervention phase for both of the dependent variables, the use of CBSP and the use of GOTR to academic instructions. Because no data points were lower than the lowest point in the baseline phase for both behaviors, the PND was 100% for all participants for both dependent variables.

Group Opportunities to Respond to Academic Instructions

In the above section the percentage intervals of occurrence and the rates of target behaviors were analyzed for each participant across the two dependent variables. GOTR to academic instructions was analyzed further by breaking down the types of GOTR to academic instructions to examine how many of each type the participants used. Table 7 shows the percentage breakdown across all intervention sessions and the maintenance session for each type of GOTR to academic instructions for all three participants.

The data for Participant A indicate that she provided gestural GOTR to academic instructions in 81% of all intervention sessions, spoken GOTR to academic instructions in 75% of all intervention sessions, and written GOTR to academic instructions in 38% of all intervention sessions. The data for Participant B indicate that she provided gestural GOTR to academic instructions in all the intervention sessions, spoken GOTR to academic instructions in 25% of all the intervention sessions, and written GOTR to academic instruction in 25% of all the intervention sessions. Data for Participant C indicate that she used all three types of GOTR in 100% of the intervention sessions.

Table 7

Percentage of Sessions in Which GOTR to Academic Instructions Were Used (by Type)

GOTR type	Teacher A	Teacher B	Teacher C
Gestural	81	100	100
Spoken	75	25	100
Written	38	25	100

Figure 13 shows the percentage distributions of the three different types of GOTR to academic instructions (gestural, spoken, and written) for all three participants. It is important to keep in mind that this figure shows the percentage of each type of GOTR to academic instructions out of the total number of GOTR (including all types) to academic instructions that occurred in a given session. These percentages do not reflect the rate of GOTR to academic instructions that occurred in the given session.

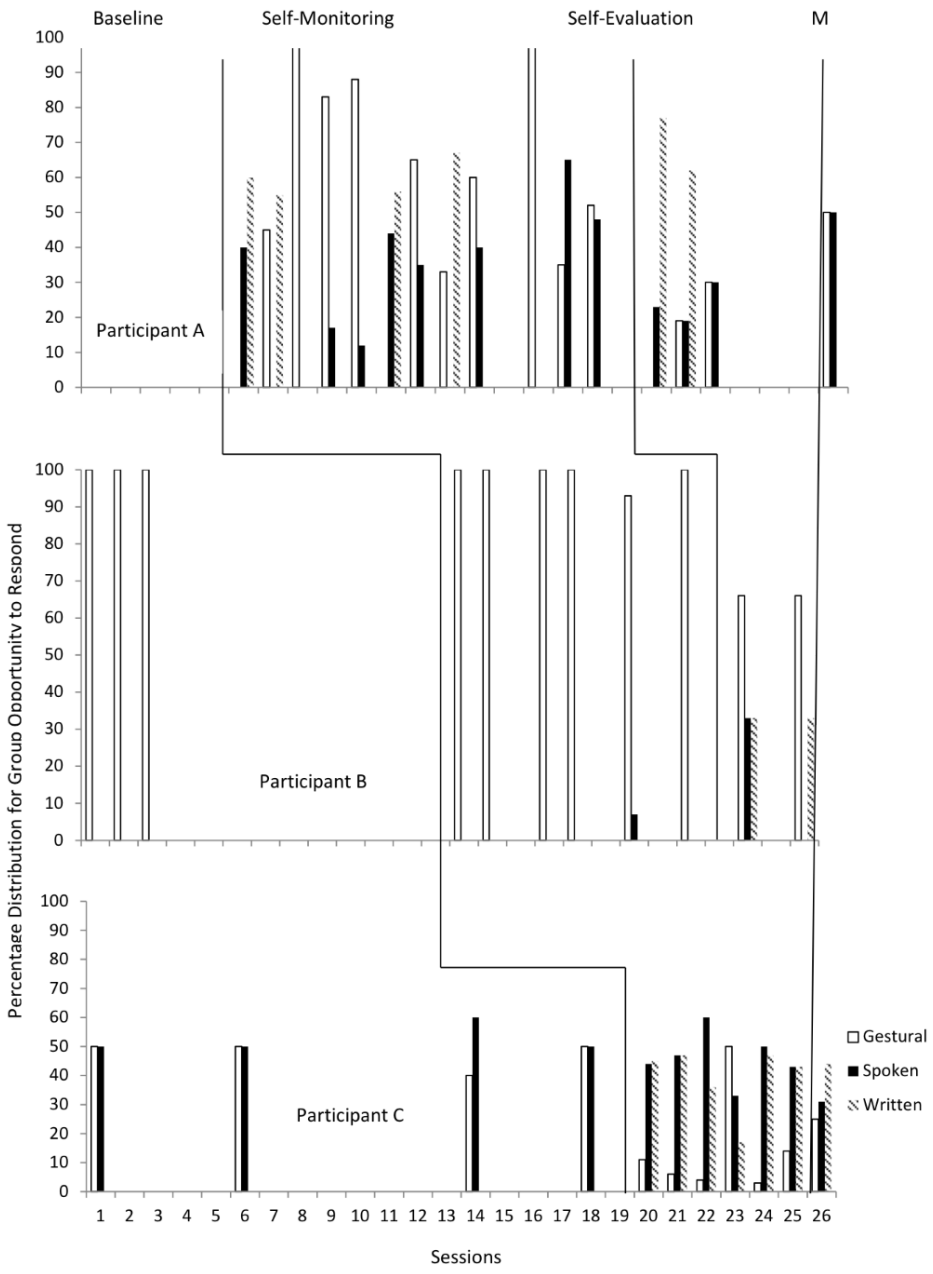

Figure 13. Percentage distribution of types of GOTR to academic instructions (gestural, spoken, and written) used across Baseline, Intervention Phase 1 (self-monitoring and visual performance feedback), Intervention Phase 2 (self-evaluation), and Maintenance (M) for all participants.

Figure 13 shows that Participant A did not deliver GOTR to academic instructions during the baseline phase. Once the intervention had been implemented Participant A began to call for group responses in spoken form and in written form. An example of such activity was presenting students with questions to answer (about a story). Students wrote their answers on their individual dry-erase boards and then displayed them simultaneously. Throughout the intervention and maintenance phases Participant A provided GOTR to academic instructions in gestural form during 81% of the sessions, GOTR to academic instructions in spoken form for 75% of the sessions, and GOTR to academic instructions in written form in 38% of the sessions.

The percentage distribution for the three types of GOTR to academic instructions for Participant A does not show a pattern in terms of which types of response were used in a given session. However, the Figure 13 does show that Participant A used at least two types of GOTR to academic instructions during a given session. Furthermore, Participant A seemed to plan her activities with particular types of responding in mind. For example, she planned a review activity or new activity using GOTR to academic instructions in written form more frequently than she planned other activities in which spoken or gestural forms were used. Participant A only brought dry-erase boards to class on days where a written-response activity was planned.

During the baseline phase Participant B provided GOTR to academic instructions in gestural form. After the intervention packet had been implemented Participant B continued to use such GOTR to academic instructions more frequently than the other two types. She used this type of responding to check for students' understanding and to see if

they agreed with certain aspects of the class. Toward the end of the intervention and the maintenance phase Participant B began to provide GOTR to academic instructions in spoken form and written form.

Participant C provided GOTR to academic instructions in gestural form and spoken form. After the implementation of the intervention Participant C began to incorporate GOTR to academic instructions in written form. This change led to a decrease in using GOTR to academic instructions in gestural form because Participant C began to replace this strategy with GOTR to academic instructions in written form. Participant C brought dry-erase boards to every class and used them throughout the class period. She also requested that students use choral responding after each main point that she or a student made verbally. In summary, her use of the three types of GOTR to academic instructions was continuous and intermixed.

Interobserver Reliability

Training and procedures for conducting the interobserver reliability check were described in the previous chapter. Table 8 provides a summary about IOA for CBSP. Table 9 provides a summary about the IOA for GOTR. Overall, the interobserver reliability scores show consistency between the two data collectors; this consistency increases the likelihood that the findings of this study are a result of the intervention itself instead of other variables.

Table 8

Interobserver Agreement (IOA) in Percentage for CBSP

Phase	IOA	Teacher A	Teacher B	Teacher C
	% of sessions	40	38	43
Baseline	Mean	100	100	100
	Range	100	100	100
Intervention Phase 1	% of sessions	36	50	43
	Mean	91	89	97
	Range	87–91	87–92	92–100
Intervention Treatment 2	% of sessions	40	100	NA
	Mean	98	93	NA
	Range	94–96	93	NA
Maintenance	% of sessions	100	100	100
	Mean	94	97	100
	Range	94	97	100

Table 9

Interobserver Agreement (IOA) in Percentage for GOTR to Academic Instructions

Phases	IOA	Teacher A	Teacher B	Teacher C
	% of sessions	40	38	43
Baseline	Mean	100	100	100
	Range	100	100	100
Treatment 1	% of sessions	36	43	43
	Mean	93	93	94
	Range	87-93	93	93-94
Treatment 2	% of sessions	40	100	NA
	Mean	98	93	NA
	Range	96-100	93	NA
Maintenance	% of sessions	100	100	100
	Mean	92	87	94
	Range	92	87	94

Social Validity

During the social validity interviews the participants were asked a series of questions regarding their prior knowledge of evidence-based classroom management strategies; the ease of the intervention, including a rating of the KIHd system app and the use of the target strategies during the intervention phase; their use of the target behaviors before and after the intervention; and behavior changes that they observed in their students.

Based on the interviews, all three participants had prior knowledge of the evidence-based classroom management strategies. As these particular strategies have been tested repeatedly with well-established experimental designs it is not surprising that the participants had learned about these strategies in their courses in special education at

the institutions where they earned their degrees. None of the participants had previous training in examining data in the format of single-subject research.

In terms of teaching strategies that the participants had used before the study Participant A said that she had not used any strategies to manage student behaviors. She had used some writing strategies that she had learned in her college courses. She also had used the dry-erase boards to engage students in learning. Participant B said the only strategy that she used was the CBSP. She had heard that visuals and PowerPoint presentations could help students, but she did not know that these are evidence-based practices. Participant C said that in her program they were only allowed to implement evidence-based strategies in teaching. Prior to participating in this study she had used GOTR, including GOTR to academic instructions, such as choral responding and hand raising.

The participants were asked about the strategies used in this study (CBSP and GOTR to academic instructions). Participant A said that they were very helpful in terms of engaging the student more in class. She felt that the class was more interesting, and she had become a more confident teacher after implementing the strategies. She thought that using the dry-erase boards required more planning than the other strategies but, nonetheless, that was one of her favorite strategies. Participant B said that she found that CBSP was easy to do, and the students responded positively to this strategy. Because of the population of her class she was initially reluctant to use choral responding and response cards, but once she had tried the response cards, she wished that she had used

them sooner. Participant C enjoyed using all the strategies, to the point that, in her words, she was "addicted to using them."

In response to questions about the ease of the intervention all three participants said that the intervention steps were easy to follow and that the KIHd system app was easy to use during academic instructions. The training on interpreting data was helpful for making subsequent decisions about instructions and lesson planning. Two of the participants said that the 10-min intervals were set appropriately, and they did not feel rushed to self-monitor their behaviors during teaching. One participant said that she would have preferred a tally of her behavior to the interval recording. However, the results of the study showed that this recording method did lead her to an instant behavior change, and the procedural integrity was within an acceptable range.

The reported benefits of using the KIHd system were its quick and easy data input and its visual graphing feature. One participant suggested putting all target behaviors on one graph so they can be seen all at once. All three participants reported that the self-monitoring and visual performance feedback really helped them to be mindful about using the target strategies. They also reported that they will use the KIHd system to record student behaviors and their own behaviors in the future to support their instructional decision-making.

Even though the data on students' behaviors were not collected in this study the researcher asked participants if they had observed any changes in students' behaviors during the course of the study. Participant A reported that her students were more engaged in the lesson. Some students also began to use CBSP with each other.

Participant B reported that students became more engaged and more on-task in the lesson. In fact, one of her students had a drastic improvement in his behavior. However, it cannot be concluded that this change was attributable to the implementation of the study. Participant C stated that her group of students was challenging to teach and they had different ability levels. The strategies helped the students reduce the amount of "chitchat" during class, and students seemed to understand the materials better during the study.

Summary

In this study, three participants went through an intervention in which self-monitoring and visual performance feedback were embedded in the KIHd system app. This intervention led to a change in the rate of delivering CBSP and GOTR to academic instructions. Because of a lack of data the effect of self-evaluation was less clear. Further analysis of the GOTR to academic instructions revealed a difference in strategy selection among the participants. An interobserver reliability check and procedural integrity support the validity of the data and the accuracy of the implementation of the intervention. Social validity interviews provided support for the social significance of the study. Social validity interviews also provided other insights about the strategies used in the study and their collateral effects on the participants and their students.

CHAPTER FIVE

The primary purpose of this study was to examine the effect of using self-monitoring and visual performance feedback (examining the graphs generated by KIHd) embedded in the KIHd system app and the effect of self-evaluation on teachers' data-driven decision-making to use CBSP and GOTR to academic instructions in a postsecondary program for young adults with intellectual or developmental disabilities. This study extended the existing literature that had examined the effect of self-monitoring and visual performance feedback on the use of CBSP and OTR in the classroom setting with the addition of an electronic data-collection tool.

This study was conducted using a single-subject, multiple-probe design to examine the two research questions. This study was designed by following the guidelines provided by Gast (2010) to ensure a high level of internal validity. From a procedural perspective the internal validity of the study was enhanced in the following ways: (a) three participants were involved in this study to allow for replication of interventions; (b) intervention was introduced in a staggered fashion after stable baselines had been achieved; (c) interobserver agreement checks were conducted for at least 36% of the sessions, with the resultant acceptable agreement across all phases and participants ensuring that consistent data collection had occurred; and (d) procedural integrity checks were conducted for at least 30% of the sessions with acceptable agreement across all

phases and participants ensuring that the intervention procedures were implemented correctly.

This chapter includes the following sections: a summary of the findings, including anecdotal findings from this study; a discussion of the social validity of the study; implications of the study; future research; and limitations of the study.

Summary of Findings

The results of the study indicated that self-monitoring and visual performance feedback embedded in the KIHd system app led to an increase in the rate of CBSP and GOTR to academic instructions for three teachers who work with young adults with intellectual and developmental disabilities in a writing class within a postsecondary educational setting. However, each participant achieved different rates for the two types of behaviors. This finding agrees with previous research that showed the effectiveness of self-monitoring and visual performance feedback as a means to increase CBSP (Cavanaugh, 2013; Mesa, Lewis-Palmer, & Reinke, 2005; Rathel et al., 2008; Reinke, Lewis-Palmer, & Martin, 2007; Simonsen et al., 2013) and OTR (Hager, 2012).

This study also supports the notion that using electronic means in the form of a data-collection system embedded in a smartphone as a self-monitoring and visual performance feedback tool can lead to changes in teachers' behaviors; this finding aligns to previous research (Amato-Zech, Hoff, & Doepke, 2006; Gulchak, 2008; Rich, 2009). Previously, Fabry and Higgs (1997) mentioned that one of the barriers to the effective use of technology in the field of education was cost. Because of the continuous growth of smartphone technology this study suggests that there is now a way for data collection,

self-monitoring, and visual performance feedback to co-occur in a single tool that can be used to change behaviors in teachers; such an approach could be cost effective in educational settings.

The behavior change that occurred during this study was socially significant because as a result of the intervention participants changed the way they interacted with their students during academic instructions. For example, Participant A did not deliver any CBSP or provide any GOTR to academic instruction before receiving this intervention. At the end of the study her rate of delivery was approximately 1 instance per minute for both behaviors; clearly the intervention increased the frequency of her interactions with her students.

The addition of self-evaluation did not lead to a definite conclusion regarding its effectiveness in changing rates in the target behaviors because only one participant proceeded to this phase of the study for more than one session. Additional research is needed to examine the effect of self-evaluation so that comparisons can be made with existing literature, such as the studies conducted by Sutherland and colleagues (2000, 2001, 2003).

The maintenance phase occurred two weeks after the intervention phase had been completed. Data collection from one maintenance session across all participants revealed that all three participants continued to use the target strategies without using the KIHd system, suggesting potential generality and retention effects of the target behaviors. However, more than one data point was needed to make a definite conclusion about the long-lasting effect of this intervention package. In comparison with previous research, a

study conducted by Reinke and colleagues (2007) found that visual performance feedback, which was one component of this intervention package, led to more frequent use of CBSP and OTR for four general classroom teachers. However, changes in behaviors occurred only during the intervention phase and were not carried over to the maintenance phase.

In another study conducted by Reinke, Lewis-Palmer, and Merrell (2008), all four participants increased their use of CBSP during the visual performance and classroom check-up phase. The rate of CBSP also increased during the maintenance phase for all four participants. In a similar study conducted by Mesa and colleagues (2005), two elementary school teachers were able to deliver more praise during the intervention phase, in which visual performance feedback was used than before receiving the intervention. The rates decreased for one participant and increased for the other participant during the maintenance phase. It should be noted, however, that in the above studies the researcher provided the visual performance feedback, unlike this study in which the participants collected data and generated graphs on their own.

Furthermore, the results of the study showed the participants all chose different strategies. Participant A used all three types of GOTR to academic instructions (gestural, spoken, and written) but was inconsistent about using all three types of responding during a particular session. Participant B initially only used GOTR to academic instructions in gestural form but began to use the other two forms towards the end of the study when self-evaluation was implemented for one session. Participant C incorporated all three types of GOTR to academic instructions throughout every session. Research has not

examined the selection preference in depth; this lacuna points to the need for more research in this area.

Research has shown that students in a special education setting received fewer opportunities to engage in instructional lessons than students without a disability (Stanley & Greenwood, 1983). The traditional method of teaching in the whole group, lecture format was found to be less effective than other teaching strategies such as a one-on-one format (Bloom, 1984). Further studies emphasized and demonstrated that using CBSP and providing GOTR during instructions can improve student participation, achievement, and classroom management (Courson & Heward, 1988; Gardner, Heward, & Grossi, 1994; Marmolejo, Wilder, & Bradley, 2004; Narayan, Heward, Gardner, Courson, & Omness, 1990). During the social validity interviews, the participants reported that an increased use of CBSP and GOTR to academic instructions resulted changes in student behaviors; this finding aligns with those of studies mentioned above.

As stated in earlier sections, collecting data, using data to make instructional decisions, and using evidence-based classroom management strategies are all important skills for teachers to exercise. Generally, teachers collect data on students' behaviors instead of on their own behaviors. In this study, the focus was on teachers self-monitoring and collecting data on their own behaviors. Results of this study showed that teachers can be taught to self-monitor, to collect data on their own behavior, and to make instructional decisions based on the data collected; these results are similar to those in previous research (Jimenez et al., 2012; Kalis et al., 2007; Partin et al., 2010; Simonsen et al., 2013; Utley et al., 1987).

Furthermore, previous research has identified the following barriers to collecting and using data to assist in the decision-making process: the nature of the setting, difficulties with data management, time, the nature of the IEPs, the level of user's skills in collecting and using data to make instructional decisions, and classroom management (Roehrig et al., 2008; Sandall et al., 2004). This study showed that, with minimal training, the participants were able to collect data on their own behaviors using the electronic data-collection tool, having received instructions that did not explicitly tell them to collect this data.

Results from the social validity interviews suggested that data collection and relevant decision-making regarding instructions were not hindered by the barriers mentioned above for the participants, such as time and level of skills. The participants enjoyed the intervention and said that they would continue to use the target strategies that they acquired during this study. It is important to keep in mind that previous studies examined data that is different from what was collected in this study, such as students' progress data or assessment data. Therefore, one should be cautious when interpreting the results and drawing conclusions.

Other Findings

In addition to findings that surround the primary research questions, there were anecdotal behavioral changes that are worth mentioning in this section. These changes were not captured by the graphs presented in the previous chapter but may help to explain the changes or patterns in the graphs. In terms of the CBSP Participant A showed a gradual increase in rate, indicating that she learned this new behavior over time.

Participants B and C already had this behavior in their repertoire, so the change in their behaviors was more drastic than that of Participant A. This difference in change in behavior suggests that prior knowledge about the target behavior may have influenced how much the behavior changed because of the intervention.

In terms of providing GOTR to academic instructions, for Participant A, the first two data points after the intervention was introduced showed an increase in rate to 0.67 instances per minute and 0.73 instances per minute, respectively. This relatively low delivery rate may have been due to the fact that Participant A was using GOTR to academic instructions in spoken and written format during those two sessions. Because these were new behaviors for her and for the students, it is reasonable to assume that the delivery rate would have been lower during those sessions. A similar pattern was noted every time written GOTR to academic instructions were used, confirming that this type of responding required more time for students to complete. During the social validity interview Participant A said using dry-erase boards required "more planning," suggesting that she viewed this strategy to be task-oriented rather than a strategy that could be intermixed with other strategies and activities.

At the beginning of the first intervention phase, participants delivered GOTR to academic instructions in more explicit ways than later on in the intervention: namely, one instruction from the participant followed by one response from the students. During the course of the intervention participants were seen to change the way GOTR to academic instructions was delivered. For example, Participant A first asked two students to answer a question together orally and then asked for a group response from all students with

response cards. Participant C first asked a student to answer a question and then initiated a group choral response in which all students repeated what the first student had said. Furthermore, both Participants B and C were observed to deliver GOTR to academic instruction in written form followed by a request for choral responding.

In terms of the use of CBSP, as the intervention continued, the participants began to use this praise format outside of the instructional period. Other teaching assistants and students also began to use CBSP. However, it is not possible to establish that this change in behavior was a collateral effect of this intervention.

Social Validity

As discussed in the previous session, the participants found the intervention to be well planned. Each component of the intervention, particularly the self-monitoring component, helped them to be mindful about incorporating the target strategies throughout the instructional sessions. During the interviews the participants brought up a few points that are worth noting in this section.

First, all participants mentioned that the introduction of the intervention changed the way that they planned their lessons. For example, they would make notes about when and where to deliver a CBSP or a type of GOTR to academic instruction in their lesson plans. However, such planning did not prolong the overall planning time. This phenomenon of planning suggests that even though the intervention focused on teacher behavior during the teaching sessions, additional work behind the scenes may have also contributed to the use of the target behaviors during instructional periods.

Second, the process of the intervention provided an opportunity for participants to reflect on their teaching strategies and student behaviors. One participant's reflection is as follows:

> Before this study I had thought that as long as I come up with interesting activities then students were going to like it and class will go smoothly. Now I understand that teaching effectively is more important than coming up with interesting activities to keep students learning actively.

Finally, the intervention had a long-lasting effect on two of the participants who are teaching in the current semester in this postsecondary program. Two months after the completion of the intervention both participants emailed the researcher about their use of the target strategies. Participant A reported that she continued to use the strategies and that they have made her a better teacher with an energetic class. Participant B reported that she continued to use the strategies acquired from the study and that she was using the response cards and choral responding in every class. She noted that the strategies continued to help her with lesson planning and student engagement.

Implications

The results of this study provide insights about the implementation of evidence-based strategies in the classroom; these strategies assisted the three teachers who participated in this study bridge knowledge and practice. In this intervention some research suggestions proposed by Simonsen and colleagues (2013) were followed and used in combination to examine the effectiveness of a relatively simple way to promote teachers' decisions to use evidence-based practices in their classroom through self-

monitoring, visual performance feedback, and self-evaluation. The results of the study add to the existing knowledge on this topic.

The researcher's involvement in this intervention was minor: conducting the training sessions. After the training sessions had been completed, the participants carried out the rest of the procedures on their own. In a real-life setting this intervention package would reduce the amount of a consultant's time needed to support the teachers as well as decrease the teachers' reliance on the consultant.

This study extended existing knowledge in several ways. First, this study was conducted in a postsecondary program for young adults with intellectual and developmental disabilities in a writing class. Prior to this study, self-monitoring strategies implemented in this setting had not been investigated. Second, the participants of the study were two new teachers and one teacher with three semesters of teaching experience. At the time of the study, none of the participants had a teaching license nor were any of them in a teacher preparation program. Existing literature has not investigated the use of evidence-based strategies or data-driven decision-making in this population of teachers. Third, the study conducted by Simonsen and colleagues (2013) examined the effect of self-monitoring on teachers' use of CBSP only. In the current study, three additional behaviors were examined in addition to CBSP to answer the question, "How many behaviors can teachers self-monitor at one time?" Even though this was not a primary research question for this study, the results provide information that may be worth considering for future research.

A further look at the use of CBSP indicates alignment with results from previous studies. Specifically, in the current study CBSP was delivered at the rate of 1.6 instances per minute (Participant A), 2 instances per minute (participant B), and 1 instance per minute (Participant C), on average. These rates are similar to those measured in a previous study (Simonsen et al., 2013) in which self-monitoring was used alone. In that study the participants delivered CBSP in a range of 0.3 to 1.23 times per minute. Results from this study also agree with what other researchers found, thus supporting the current finding that self-monitoring is an effective way to create behavior change in teachers (Kalis et al., 2007; Keller & Brady, 2005; Partin et al., 2010; Sutherland & Wehby, 2001).

Another dependent variable in the study was the use of GOTR to academic instructions. This intervention package led to an instant increase in rate for all three participants. This finding is consistent with the limited research that has been done in this area. For example, Sutherland et al. (2003) conducted a study that showed that the use of performance feedback led to an increase in providing OTR in an educational setting for students with emotional and behavioral disturbance. In their study OTR included individual responding and group responding together.

In addition to self-monitoring, the use of data to support making decisions concerning instructional practices was also a part of this study. In this study, the KIHd system, which is an electronic data-collection tool, was used to help teachers self-monitor and to provide visual performance feedback. According to the reports from the participants, the KIHd system was easy to use. Previous studies that examined the use of

data reported that teachers were reluctant to collect data because of the time factor (Farlow & Snell, 1989; McLean et al., 2004) and skill level (Katsiyannis et al., 2003). Teachers also struggled to use data to support their decision-making because of a dependence on intuition and experience (Grigg et al., 1989). The current study suggests that with technological support, the participants were able to collect data and make relevant decisions regarding their instructions based on the data they had collected and the graphs produced with these data. This finding confirmed the suggestions made by previous researchers about incorporating technological support into data collection and data-driven decision-making (Shi et al., 2006; Sulser, 2006; Wayman, 2005).

Future Research

While this study provided a way to promote the use of evidence-based strategies in the classroom, it is important to keep in mind that this intervention package is not the solution that will enable all teachers to begin implementing evidence-based classroom management strategies. Therefore, additional replications are needed in a variety of contexts, across additional participants, in different content areas, and with a variety of modalities of instructional delivery to increase the external validity of the study. Teachers differ in terms of education, teaching experience, skill sets, and reinforcement for teaching. Therefore, this intervention may work for some teachers, but not for others. Additional research can focus on investigating supplementary support for those teachers for whom this intervention package does not lead to a desirable change in behavior, such as the self-evaluation component that was incorporated in this study.

In addition to considering other support that could be added to this intervention package, it is also worthwhile to examine the effect of each individual component of this intervention: training, self-monitoring, visual performance feedback, and self-evaluation. This examination may lead to an even simpler version of the intervention that could achieve similar behavior changes in teachers. With respect to the dependent variable, it is also worthwhile to examine the rate of GOTR individually. It is possible that focusing on one type of GOTR to academic instruction at a time might lead to a greater change in rate. In addition, researchers could investigate the impact of this intervention for other uses of other instructional strategies.

In addition to investigating ways to promote the use of GOTR to academic instructions in the classroom, it is also important to understand why certain strategies are not being used. The percentage distribution of the types of GOTR to academic instruction used by the participants showed that teachers had preferences in their selection of strategies. The social validity interview revealed that one participant did not use choral responding and response cards until the end of the intervention because of concerns about students' abilities. To understand this phenomenon further, researchers could explore the reasons behind such preferences in strategy selections or ways to support special education teachers in particular.

One of the limitations of the study is measurement of student performance. The current study showed that self-monitoring and visual performance feedback increased teachers' use of CBSP and GOTR to academic instructions. However, how the participants' behavior changes influenced the students' behaviors and their achievement

was not explored. Future replication studies should measure student behaviors in a direct way or by using achievement scores to evaluate the effectiveness of instructions.

Furthermore, the participants in this study enjoyed using a system that helped them to acquire several evidence-based classroom management strategies in a continuous way. They reported that this intervention was meaningful and was more effective than hearing about a strategy in a professional development session, which frequently would not get used in the practical teaching setting. This information provides researchers and trainers a direction to use in creating effective training models, which will then require scientific validation of their effectiveness.

Limitations

Because of the exploratory nature of this study there are a few limitations that should be kept in mind when the results and conclusions are examined. First, the nature of the setting where this study was conducted and the small number of participants make it difficult to generalize the findings to the larger population. However, the design of the study and its relevant components provide rich information on the individual level with a high degree of internal validity shown by interobserver agreement and the procedural reliability check.

Second, during the intervention phase the participants recorded their use of CBSP and GOTR to academic instructions using a method of interval data recording. While a continuous recording method would have been a more accurate data-collection method than the interval recording method, the method used was appropriate given the level of engagement needed during the teaching sessions.

Third, while there is an accepted optimal rate for using CBSP praise, this rate was not adjusted for the teaching environment in this study—a postsecondary educational environment for students with intellectual or developmental disabilities. Similarly, there is no optimal rate suggested for the delivery of GOTR to academic instruction in the environment in this study. This information could have been helpful in establishing a criterion level for participants to reach. This limitation calls for future research with results that can be used by teachers and practitioners in the field of special education.

Fourth, because the postsecondary program used in this study ran on a semester basis limited sessions were available for data collection. This time constraint meant data collection for self-evaluation only occurred once for Participant B and maintenance data were collected for only one session for all three participants. A lack of data points made it difficult to draw a conclusion concerning the effectiveness of self-evaluation. The maintenance of behaviors in the postintervention phase was also difficult to determine.

Finally, the focus of this study was on teachers' behavior, not students' behaviors. However, an examination of student behaviors might have provided additional information that could explain or support participants' performance during the intervention. In addition to creating behavioral changes in the participants, it is possible that this intervention also caused changes in student behaviors and performance due to changes in teachers' behavior. Potential behavior changes in students were examined during the social validity interviews. The lack of in-depth exploration of changes in students' behavior is a limitation of the current study that points to a direction for future research in which student behaviors can be examined experimentally.

APPENDIX A

GEORGE MASON UNIVERSITY

Office of Research Integrity and Assurance

Research Hall, 4400 Univeristy Drive, MS 6D5, Fairfax, Virginia 22030
Phone: 703-993-5445; Fax: 703-993-9590

DATE:	August 14, 2014
TO:	Anastasia Kitsantas, PhD
FROM:	George Mason University IRB
Project Title:	[642323-1] Engaging special education teachers in data-driven decision making through the use of the KIHd system: Effects on teacher use of evidence-based strategies
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	August 14, 2014
EXPIRATION DATE:	August 13, 2015
REVIEW TYPE:	Expedited Review
REVIEW TYPE:	Expedited review category #7

Thank you for your submission of New Project materials for this project. The George Mason University IRB has APPROVED your submission. This submission has received Expedited Review based on applicable federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by the IRB prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to the Office of Research Integrity & Assurance (ORIA). Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed (if applicable).

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to the ORIA.

The anniversary date of this study is August 13, 2015. This project requires continuing review by this committee on an annual basis. You may not collect date beyond this date without prior IRB approval. A continuing review form must be completed and submitted to the ORIA at least 30 days prior to the

anniversary date or upon completion of this project. Prior to the anniversary date, the ORIA will send you a reminder regarding continuing review procedures.

Please note that all research records must be retained for a minimum of five years, or as described in your submission, after the completion of the project.

If you have any questions, please contact Karen Motsinger at 703-993-4208 or kmotsing@gmu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

APPENDIX B

Recruitment email:

Good morning/afternoon,

I'm looking to conduct a study on the use of a mobile data collection application on teachers' use of evidence-based classroom management strategies. The reason for conducting this research is to find ways to bridge the gap between research and practice for utilizing these practices in the classroom. Participants will receive a training session about using the data collection application followed by using it during teaching. This study should occur over a 2-months period (fall semester of 2014) during normal class periods. Participants will participate in a short interview upon completion of the study. Please respond to this email if you are interested in participating. Thank you!

I am a PhD candidate in the Graduate College of Education at George Mason University.

Thank you!

Dorothy Zhang

PhD candidate, George Mason University
College of Education and Human Development
dzhang3@gmu.edu

APPENDIX C

Examining the use of evidence-based strategies in the classroom

INFORMED CONSENT FORM

RESEARCH PROCEDURES
This research is being conducted to investigate the use of evidence-based classroom management strategies. There are three phases to this study: initial observation, intervention, and maintenance. If you agree to participate, the observation and maintenance will require you to teach lessons as you normally would. In September 2014, you will receive a training session about using the KIHd system, which is a data collection smartphone application. This training session will last about an hour. During intervention, you will be using skills acquired during the training in teaching. This study will occur during the fall semester of 2014. At the end of the study you will be participate in a short interview about the study. This interview should take about 45-60 minutes of your time and it will be audio recorded. All sessions will be video recorded during the study for data collection and reliability check purposes.

RISKS
There are no foreseeable risks for participating in this research.

BENEFITS
There are no benefits to you as a participant other than to further research in the use of evidence-based strategies in the classroom.

CONFIDENTIALITY
The data in this study will be confidential. You will be assigned a letter code so your name will be kept confidential at all times including on the data sheet and in future writing about this study. No one but the researchers shall have access to the data.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

CONTACT
This research is being conducted by Dorothy Zhang, a Ph.D. student in the Graduate School of Education at George Mason University. She may be reached at (434) 227-6480 or dzhang3@gmu.edu for questions or to report a research-related problem. You may also contact the faculty advisor, Dr. Anastasia Kitsantas at (703) 993-2688. You may contact the George

Mason University Office of Research Integrity & Assurance at (703) 993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

CONSENT
I have read this form and agree to participate in this study.

_____
Name

_____
Date of Signature

APPENDIX D

Measuring Dependent Variable

Target behavior (Dependent variable)	How to measure
Contingent behavior specific praise	A tally mark (/) is written on the data sheet when the participant provides contingent behavior specific praise (i.e., "Good job answering that question!") in the video recording. The data sheet is provided in Appendix C under "contingent behavior specific praise."
Group opportunities to respond to academic instructions (written)	A tally mark (/) is written on the data sheet when the participant provides group opportunities to respond in written form (i.e., "Everyone write down the answer on the board and show me together") in the video recording. The data sheet is provided in Appendix C under "Group opportunities to respond (written)."
Group opportunities to respond to academic instructions (spoken)	A tally mark (/) is written on the data sheet when the participant provides opportunities to respond by choral responding (i.e., "Everyone answer together.") in the video recording. The data sheet is provided in Appendix C under "Group opportunities to respond (choral)."
Group opportunities to respond to academic instructions (gestural)	A tally mark (/) is written on the data sheet when the participant provides opportunities to respond by hand raising (i.e. ,"Raise your hand if you agree with the answer") in the video recording. The data sheet is provided in Appendix C under "Group opportunities to respond (gestural)."

APPENDIX E

Task Analysis for Using the KIHd System

(Used during training)

1. Teacher opens the KIHd app by pressing the icon on the main page.
2. On the KIHd main screen click start.
3. On the Data Dashboard screen select “click to choose” next to the program label.
4. Select Target behavior program button.
5. Select the “Run” button next to “self-monitoring” program – this should take you back to the previous stage.
6. Select the “start” button.
7. Select “start” next to the timer.
8. Set aside the iPad and begin teaching.
9. When the timer goes off come back and press the home button on the iPad to return to the data-collection screen.
10. Record behavior that occurred during the interval.
11. Set aside the iPad and begin teaching.
12. When the timer goes off come back and press the home button on the iPad to return to the data-collection screen.
13. Repeat Steps 11 and 12 for all 6 (or 7) intervals.

14. When the session is over click “stop” next to the timer to end the session.
15. Click the “back” button to return to the Data Dashboard.
16. Generate graphs by selecting “view graph”.
17. On the Behavior Screen select the behavior to review by pressing the icon “YP”.
18. Review the graph.
19. Select “back” to return to Data Dashboard, and this will allow for data collection for the next time.

APPENDIX F

End-of-Training Questions

1. What are the two target behaviors that you will be focusing on?
2. When interpreting a graph, which three elements do we focus on?
3. What is a trend?
4. What is a level?
5. What is variability?
6. Interpret this graph (Graph 1).
7. Interpret this graph (Graph 2).
8. Interpret this graph (Graph 3).
9. Talk about how you will use the KIHd system to monitor how you did during teaching.
10. Talk about how you will generate graphs using the KIHd system.
11. Talk about what a session will look like.

APPENDIX G

Self-Evaluation Guided Questions
(Participant discusses the following questions.)

Contingent behavior specific praise is:

1. The level of the graph is:
2. The trend of the data is:
3. The variability of the data is:
4. Overall here is how I am doing:
5. What I will do tomorrow:

Group opportunities to respond (written) are:

1. The level of the graph is:
2. The trend of the data is:
3. The variability of the data is:
4. Overall here is how I am doing:
5. What I will do tomorrow:

Group opportunities to respond (choral) are:

1. The level of the graph is:
2. The trend of the data is:
3. The variability of the data is:
4. Overall here is how I am doing:
5. What I will do tomorrow:

Group opportunities to respond (gestural) are:

1. The level of the graph is:
2. The trend of the data is:
3. The variability of the data is:
4. Overall here is how I am doing:
5. What I will do tomorrow:

APPENDIX H

Data-collection Form

Contingent Behavior Specific Praise

Session	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

Group Opportunities to Respond (Gestural)

Session/condition	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

Group Opportunities to Respond (Spoken)

Session/condition	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

Group Opportunities to Respond (Written)

Session/condition	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

APPENDIX I

Maintenance Data-Collection Form

Contingent Behavior Specific Praise

Session	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

Group Opportunities to Respond (Gestural)

Session/condition	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

Group Opportunities to Respond (Spoken)

Session/condition	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

Group Opportunities to Respond (written)

Session/condition	Interval 1	Interval 1	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7

APPENDIX J

Procedural Integrity Check for Intervention
(Mark Yes+ /No- for each step)

1. Participant launches the KIHd system on iPad ___
2. Begin instructions _____
3. Record data for Interval 1 _____
4. Record data for Interval 2 _____
5. Record data for Interval 3 _____
6. Record data for Interval 4 _____
7. Record data for Interval 5 _____
8. Record data for Interval 6 _____
9. Generate graph for contingent behavior specific praise _____
10. Generate graph for GOTR (gestural) _____
11. Generate graph for GOTR (spoken) _____
12. Generate graph for GOTR (written) _____

APPENDIX K

Exit Interview Questions

1. Tell me about the strategies that you had used before this study.
2. Prior to this study, were you using evidence-based strategies in your classroom to address behavior challenges? If so, which ones? (Rephrase this question as above)
3. Describe your experience using the strategies during this study.
4. Since the end of the study tell me how you have been using these strategies. Why did you choose to use it or them?
5. Tell me about the strategies that you are not using. Tell me why you chose not to use them.
6. How would you rate the KIHd system (on a scale of one to five, with one being easy and five being hard)?
7. What do you see as the benefits of using the KIHd system?
8. What were the challenges of using the KIHd system?
9. What behavioral changes did you see in the classroom during the course of the study?
10. What changes would you suggest regarding the intervention and technology?
11. Is there anything else you would like to tell me about your experience during this study?

APPENDIX L

Demographic Questionnaire

Please provide the following information

1. Gender: F / M
2. Age: _____
3. Degrees held:

   _____

4. If you are a current student, what program are you enrolled in?

   _____

5. How long have you taught in this postsecondary program? _____
6. What content area do you teach in this postsecondary program this year? _____
7. Please describe your previous teaching experience (i.e., tutoring, public school, private school)

   - Position _____
   - Location _____
   - Length of time _____
   - Responsibilities _____
   - Age of the students served _____
   - Content area taught _____

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